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EAST ORANGE, NEW JERSEY

(Subsidiary of Bendix Aviation Corporation)

AERO DIGEST, *July*, 1935
Volume 27. *Number* 1

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125 lbs.	Baggage Allowance	125 lbs.
700 miles	Cruising range	750 miles
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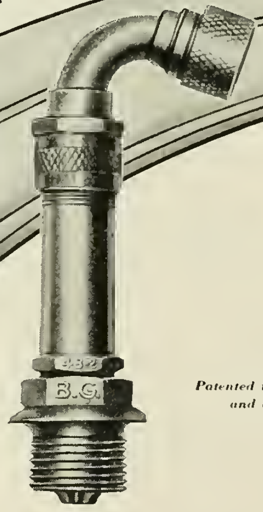

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The DC-1...first of the 100 Douglas Transports that have been produced for world use...continues to demonstrate the outstanding superiority of these airplanes. Flying for TWA the DC-1 now holds the coast-to-coast record of 11 hours, 5 minutes, and has established two new world speed records, broken 6 existing world and 3 American records, and set 8 new American records with loads for distances up to 5000 kilometers.

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TRANSPORT

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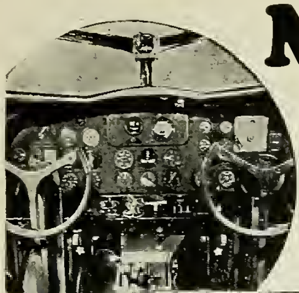

Training, systematic and comprehensive, is essential for the pilot in command in a cockpit like this

At work in instrument laboratory

The number of travelers on scheduled air transport lines increased from 5782 in 1926 to 561,370 in 1934. Many authorities agree that in 1940 the number will be 5,000,000 or more.

You can cash in on this phenomenal growth—secure rapid promotion and a correspondingly substantial income provided you obtain the training necessary to enter the industry and, at the same time, secure the broad educational background which is essential for advancement. Parks Air College offers you the training and educational background necessary.

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Here is what a major aircraft manufacturer of privately owned planes wrote in reply to a father's request for information about Parks Air College: "We have found that any man recommended to us by Parks Air College is thoroughly and highly capable for the work they recommend and we always turn to them when we need additional men."

Another equally prominent manufacturer who builds high speed, twin-engined transports replied to a similar inquiry this way: "It gives me great pleasure unqualifiedly to endorse Parks Air College as an outstanding institution for the teaching of aeronautical science in all of its phases.

"This corporation has among its employees many Parks graduates, many of whom have been with us five years, and in *every instance* they have proved ambitious, capable, loyal employees."

The President of one of America's largest airlines, who already had many Parks trained men in his organization, wrote to Oliver L. Parks, President of Parks Air College under date of May 27: "We will soon require six more of your graduates. These men will be stationed along our route and will ultimately act as dispatchers and so must be familiar with our equipment, our route and have meteorological training. As they must contact the public they must be of good appearance, have a good educational background and sales ability.

"Look over your available graduates and send me data on six of them."

Another Operations Manager who employs dozens of Parks graduates and, when in need of additional men, always requests more Parks graduates, writes: "You will be interested in knowing that all the Parks men in our company are doing excellent work."

Because of the thoroughness of Parks training—because of the excellent recognition given Parks graduates throughout the industry—and because of the rapid expansion of aviation you can be assured that your Parks training will bring you excellent returns in the form of interesting work, rapid advancement and the satisfaction which comes from being of superior value in a great industry.

Since the Fall term opens September 30 you will want to get complete information at once, so send for the catalog and outline of courses.

The coupon will bring them to you. Fill it out and mail now.

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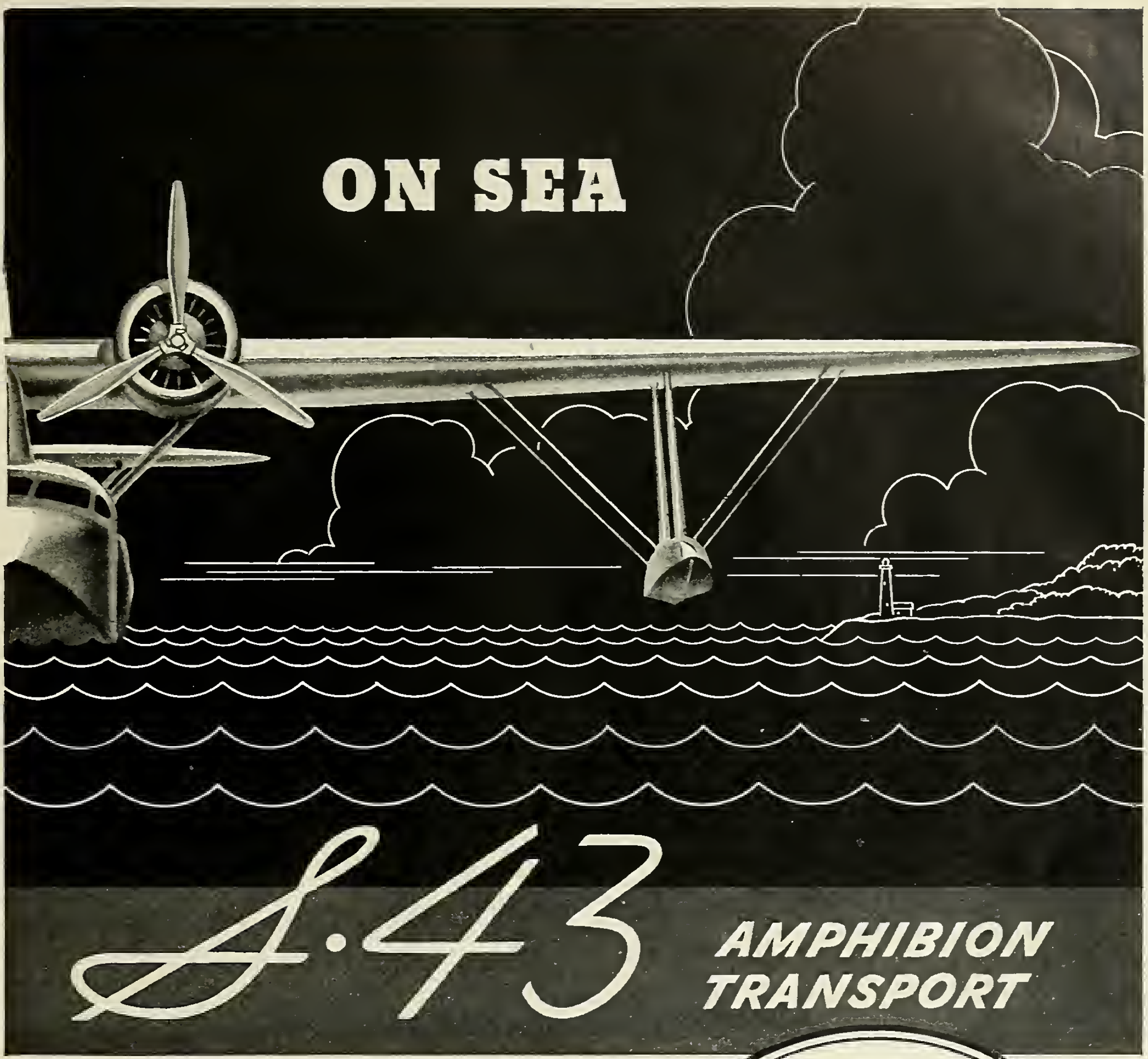
SIKORSKY AIRCRAFT CORPORATION



power Pratt & Whitney geared Hornet engines. A very definite traffic builder for transport lines.

The interior of the ship may be easily rearranged for increased passenger accommodations with equal comfort. If used exclusively as a long-range mail transport, the S-43 offers a range of 2,000 miles with a payload of 1,100 pounds. Cruising speed is 181 miles per hour at 8,000 feet at 75% of available power. A high speed of 200 miles per hour is attained at rated altitude.

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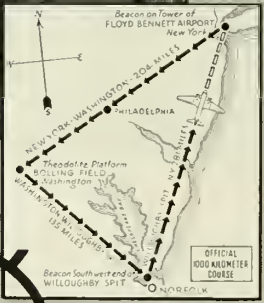
TWA Pilot Joe Bortles (left) ond D. W. Tomlinson, Assistant to the President of TWA.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E
S
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OFFICIAL 1000 KILOMETER COURSE

Course over which TWA established world records May 16 ond 18, 1935.

Further evidence of the superiority of TWA Douglas Skyliners was demonstrated when Lieutenant Commander D. W. Tomlinson and Joseph Bartles, flying an official triangular course, broke six world and three American records—set eight new American and two new world records. Average speeds of better than 191 MPH were recorded. Sister Ship to TWA's famous Sky Chief, the record-breaking plane was equipped with Sperry Gyro-Pilots and Automatic Stabilizers.

TWA

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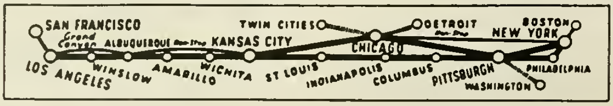

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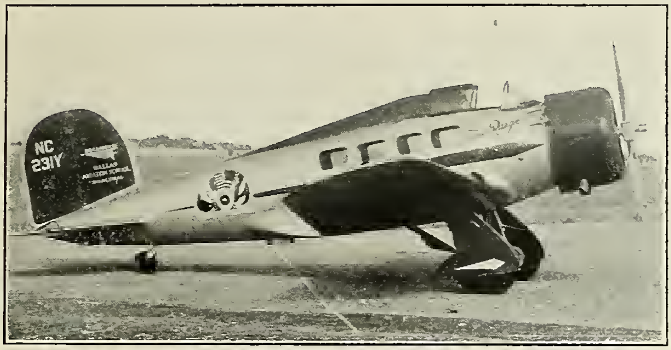

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"CLEVELAND: low clouds ... ceiling estimated at 300 feet ... visibility, one-half mile, with moderate fog ... temperature 35 ... dewpoint 35 ... wind blowing from south-southeast 10 miles an hour ... barometer 29.74 ... fog closing in rapidly."

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Sikorsky S-43, Powered With Two 750 h.p. Pratt & Whitney Engines, For Inter-Island Airways' Service Between the Hawaiian Islands.

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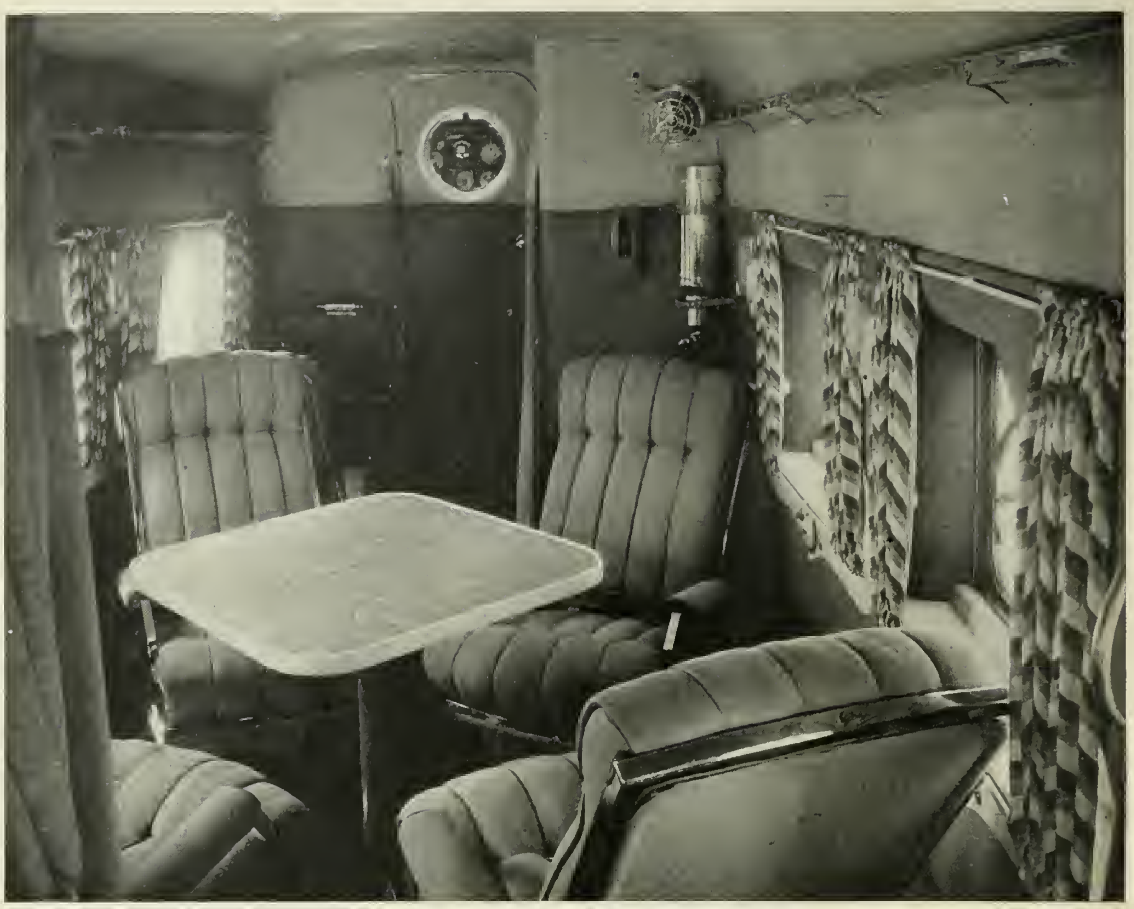
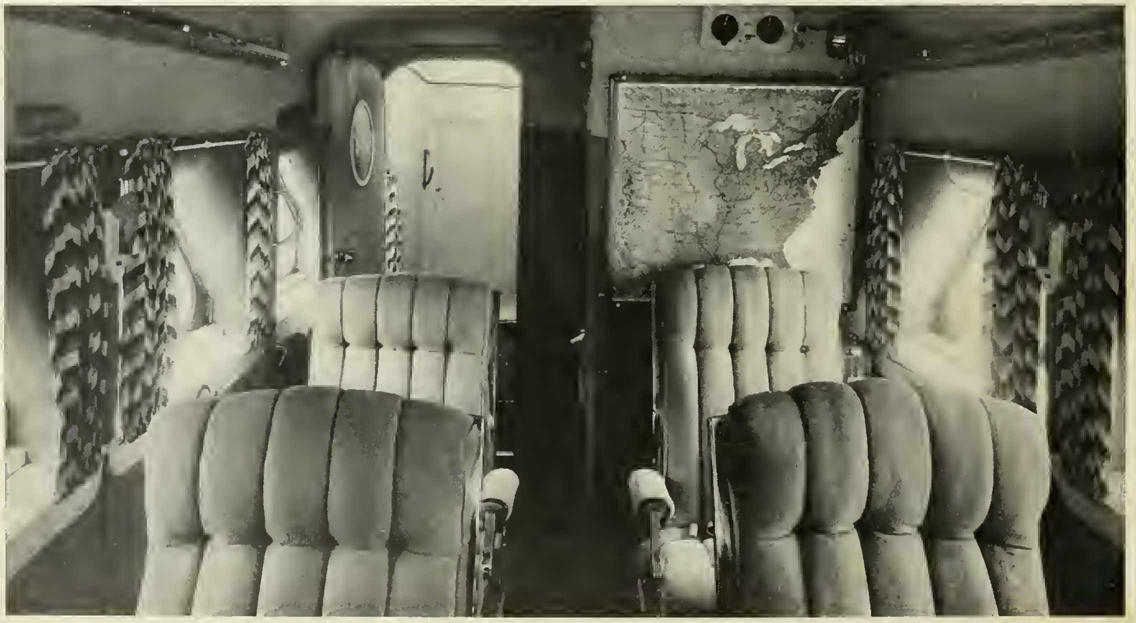




Modern ideas in interior decoration and appointments as featured in the Stinson Executive Trimotor of R. J. Reynolds. Looking forward, the pilots' instruments may be seen through a circular window; to the right is a cloak room and a two-way RCA radio telephone. Chairs may be grouped around the removable table or swung to leave a center aisle. The lower view shows the after part of the cabin, on the right of which (behind the wall map) is a room containing a full size sleeping berth.

More Dope On C. Grey Grey's Great American Airway Bluff

●

CY CALDWELL

● I hope you boys were with me last month when I took the Great Grey Grey over the well-known jumps for his inverted literary effort entitled *The Great American Airway Bluff*. That was only the beginning. Here's an analysis made by Transcontinental & Western Air, Inc., of the airline flying speeds of types of equipment in use May 1, 1935 by the major domestic airlines of the good old U.S.A. These figures are taken from the published tariff folders and time tables of that date.

But before going into that, I should explain briefly what I made clear in June AERO DIGEST: that Mr. Grey used obsolete figures taken from the inventory listings of the various airlines during the early winter of 1934, which included the oldest and most obsolete equipment, the bulk of which is in all cases either for sale or held for emergency service on the short lines where there are many stops. From these figures my ingenious and monocled friend across the ocean deduced that we were bluffing when we claimed that our airlines operated at high speeds—he even included an old Eaglerock stored in a hangar somewhere!

Now, there is one way, and *only* one way of finding out how fast an airline flies its equipment in scheduled operations; and that is by taking the block-to-block time—miles per hour average system speed. This is found by taking the time at which the wheels of the airplane start turning when the machine taxies out to take off, until the time when the wheels stop turning when the ship has taxied up to the station in the next city. Those are the actual departure and arrival times advertised in the tariff folders. If, for instance, a ship stops at Cleveland and Toledo en route from New York to Chicago, the block-to-block time would exclude the ten minutes spent stationary on the ground at those intermediate stops, but would include all taxiing time at all four cities mentioned. Hence block-to-block speed is appreciably *less* than the actual cruising speed of the ship; but it is the only speed that we may use when comparing speeds of the world's airlines. If we treat all of an airline's scheduled flights in like manner we get the block-to-block speed in miles per hour average for the whole system, indicated hereafter by initials BBS. The analysis, also illustrating the fastest scheduled flights, as prepared by TWA, is shown in the table on the next page.

The equipment listed includes *all* of the airplanes used on May 1, 1935 in scheduled operations by these airlines. No other types were in service on scheduled flights. Their inventory lists probably included other obsolete types used in maintenance work or emergency trips, or held for sale. These are the major airlines; some operators have been omitted due to their lesser importance or their failure to list information as to mileage and/or equipment on their time tables.

Now, there is no bluff or hocus pocus about those figures; they are not pulled out of a hat in the U. S. Department of Commerce, or taken from manufacturer's test figures on cruising speeds. They are taken from the time and mileage tables, and, to add a few more rips to C.G.G.'s parachute we cordially invite him to send us a list of the block-to-block speeds for English airlines, both internal and on the continent of Europe. Meanwhile from Bradshaw's *International Air Guide* for May, 1935, I learned that Hillman's Airways flies the 225 miles between Essex (near London) and Paris in 2 hours, a block-to-block speed of 112.50 m.p.h. And this comparatively low speed is, I understand, made by the DH 86, which has an official "cruising speed" according to Mr. Grey of 147 m.p.h. Imperial Airways, using the *Heracles* or the *Scylla* class of airliner, flies a shorter route from Croyden to Paris, a distance of 205 miles in 2 hours 15 minutes—a block-to-block speed of only 91.11 m.p.h. They serve full dinners on those machines; you have to pass the time somehow.

Now, that London to Paris run may fairly be compared to our own New York-Washington run of Eastern Air Lines, which knocks off the 203 miles in just 1 hour 20 minutes in Douglases, a block-to-block time of 152.29 either way, Northbound or Southbound. That is 40 m.p.h. faster than the DH 86 and 61 m.p.h. faster than the *Heracles* and *Scylla*. And as London-Paris is the show route of the British Empire, so far as the average American traveller is concerned, naturally the English put their best foot forward on that run. The block-to-block average speeds for the two systems mentioned may be considerably below those London-Paris figures. I'll give them to you if Mr. Grey has the heart to admit them as he slideslips his all-mental aeroplanes. He is very fond of comparing the "cruising speeds" of English machines to the operating speeds of American airliners. But that term "cruising" is one of the most abused terms in aviation. I once "cruised" a Martin 66 for about 2,500 miles in the first Ford tour—with the throttle wide open all the way. As Mr. A. E. Raymond, Chief Engineer of Douglas Aircraft, Inc., writes:

"You will note that cruising speed is entirely indefinite unless tied down by accurate description. Thus the Douglas DC-2 cruises at 200 m.p.h. at 75% power at 14,000 feet, but cruises at 168 at 28.5" manifold pressure at 2,500 feet. Operators of DC-2's in this country have been able to keep ahead of competition by restricting cruising power to 50% or 60%, and since this results in an increase in engine reliability and decrease in engine maintenance it is quite natural that they should not exceed these figures with conditions as they exist at present."

Mr. Grey insists upon reporting the Douglas cruising speed at 165 m.p.h.—the official sea level figure. But in scheduled operations across the continent the Douglas doesn't fly at sea level. So let us look at the time tables for some representative Douglas flights and thus knock our friend's 165 m.p.h. into a cocked hat. TWA's No. 18, Eastbound non-stop from Chicago to New York has a block-to-block speed of 188.30 m.p.h.—a scheduled time of 3 hrs. 58 min. for the 747 miles. It would take one of Imperial Airways' old lumber wagons complete with five course dinner 8 hrs. 20 min. to wallow over the same distance! Shades of the first Ford tri-motor!

Some more fast Douglas scheduled flights: TWA's *Sky Chief* No. 8, Eastbound, Los Angeles to New York, 2,612 miles, with stops at Albuquerque, Kansas City, and Pittsburgh, scheduled time block-to-block, 14 hrs. 12 min., m.p.h.—183.94. The Westbound schedule, against the prevailing winds, calls for 16':25", speed 159.10 m.p.h. Mr. Grey says they can't do it, because the "official cruising speed" is only 165. From Los Angeles to Fort Worth, Texas, 1,320 miles, American Airlines fly their Douglases in 7':42", a block-to-block speed of 171.43. The return trip starts at Dallas, 29 miles from Fort Worth, a distance of 1,349 miles to Los Angeles, in 8':56", speed block-to-block 151.01. American's *Southerner* from Dallas to New York, via Washington, 1,402 miles, in 8':44", block-to-block speed 160.54. Returning, direct to Fort Worth, 1,320 miles, in 9':35" scheduled time, 137.74 m.p.h. block-to-block. On TWA's New York-Chicago run, Westbound, they schedule the Douglas for 4':40", a block-to-block time of 160.06—(Eastbound, 188.30). On a recent test flight a Douglas was flown from Los Angeles to New York for laboratory purposes in 11 hrs. 5 min. for the 2,612 miles.

Possibly a reason for Mr. Grey's article depreciating American airlines lies in the fact that American transport airplanes are out-selling British machines in world markets. For instance, in the March 27, 1935, issue of the *Aeroplane*, on page 354, he wrote: "We have lost an immense export trade through not producing what the market wanted. Douglases are being ordered in dozens, and will soon be delivered to our next-door neighbor under our noses,—simply because, as in the motor trade, we kept our ideas to our own backyard instead of looking over the fence to see what other people wanted." Yet only a month and a half later, he writes, May 1, the *Aeroplane*, page 491: "They (the Americans) just happen to have struck it lucky by having two types of machine which are very good in a category which we do not happen to have touched because it is not commercial." He refers here to the Douglas and Boeing. What does he mean—"not commercial?" Have the K. L. M. people of Holland bought 15 Douglas transports only to lose money on operating them? Mr. Grey is not always consistent. Sometimes he becomes over-buoyant and rises to heights of bliss and confusion denied us ordinary mortals. In order to refute some of Mr. Grey's mis-statements it is ofttimes necessary only to glance casually through back issues of the *Aeroplane* and he will obligingly supply you with material written by his own hand; for C. G. G. apparently has the happy faculty of not letting his right hand know what his left hand has written.

I have some figures from Gordon D. Brown of the Douglas Co., which explain further Mr. Grey's annoyance at the Douglas. They concern exports. Douglases totalling 29 have been sold in China, Japan, Holland, Austria, Germany, Switzerland, Dutch East Indies (17 went to Holland, 4 to Switzerland). In the United States 29 have been sold to TWA; 12 to Eastern Air Lines; 13 to American Airlines; 3 to the U. S. Navy and Marine Corps, and two to private companies. Douglases are flying more than 50,000 miles daily. The 100th Douglas was completed June 5, 1935. (The first one was finished May 15, 1934). So in a little more than a year the enterprising Douglas Co., turned out 100 of these aerial thorns in the flesh of C. G. G. However, the British Government, taking pity on Mr. Grey and his sufferings, offered a prize of £25,000 Sterling for a plane that will beat the Douglas. And as an admission that the Americans are still away ahead, I find this frank statement in Mr. Grey's own words in the *Aeroplane* of April 17, 1935, on page 430: "This competition is intended to promote the immediate progress of British air transport in competition with American products. As a correspondent says on our last page, if there had been no Douglas there would have been no £25,000 prize from the Air Ministry. And we want to beat the Americans in 1936, not in 1937 or in 1938."

Such candor is refreshing. And I may add that any time we folks over here can stimulate the production of some modern transport airplanes in England, by building better ones over here, we shall be happy to extend such encouragement. After all, an American named George Washington taught an Englishman named Lord Cornwallis how a war should be fought, though by the time Lord Cornwallis got the idea, the war was over, and he had surrendered at Yorktown. He afterwards wrote a letter to the *Times* complaining of the lack of military culture over here. If Mr. Grey gets mad enough, he'll write to the *Times*, too—all Englishmen do, sooner or later.

I wrote rather fully about the Boeings last month, so all I'll do now is to mention a few of the faster scheduled flights. United flies their Boeings from Chicago to New York in 4':04", a block-to-block time of 177.32 m.p.h. The return trip is made in 4':50", speed 149.80. (Mr. Grey found that the operating speed was only 127 m.p.h., but he was a year and a half behind, and some of the machines he figured in were disassembled and stored in hangars as obsolete material!) United's BBS is 142.75 m.p.h. Their San Francisco-New York run, 2,720 miles is made in a block-to-block time of 18':12", speed 148.63, Eastbound. The return trip takes 19':20", at a speed of 140.68. This excludes, of course, an hour and a half spent on the ground at several stops, but includes all taxiing time at those stops. And the Boeing isn't being pushed to maintain these schedules.

There is an impression abroad that all we have over here are Boeings and Douglases, because they beat everything in the London to Melbourne race except one DH *Comet* racing plane—*and in-*

(*Continued on page* 117)

Airline Operator	Type of Equipment	Block-to-Block Time		Fastest Scheduled Flight		Distance (miles)
		Average Speed (m.p.h.)	System Speed (m.p.h.)	(m.p.h.)	(cities)	
TWA	Douglas	.....	161.61	188.30	Chicago-New York	747
American	Condor	118.81	134.58	184.65	Dallas-Chicago	914
	Condor Sleeplane	128.77				
	Douglas	156.80				
	Vultee	164.58				
	U-Stinson	89.23				
United	Boeing	.....	142.75	177.32	Chicago-New York	724
Eastern	Douglas	157.26	133.19	159.56	New Orleans-Chicago	1077
	Condor	104.94				
Pennsylvania	Ford	90.18	113.93	145.01	Detroit-Washington	423
	Boeing	131.25				
Central	Ford	102.64	119.74	132.57	Detroit-Washington	464
Bowen	Vultee	147.89	158.37	180.67	Ft. Worth-Houston	271
Northwest	Electra	150.15	147.98	156.50	Seattle-Chicago	1891
	Hamilton	105.15				
Braniff	Electra	137.34	135.45	143.73	Brownsville-Dallas	563
	Vega	134.11				

Equipment and operating speeds of typical American airlines

AIR
HOT AND OTHERWISE

Five Billion Dollars for Relief! How Much for Accident Reports?

FRANK A. TICHENOR

● Is the Department of Commerce playing traitor to itself? The dispute over the TWA crash report has shocked the industry with that question. The Bureau of Air Commerce heaps the entire blame in the lap of TWA. That airline throws the hot potato right back by replying that the accident resulted from a failure of the Bureau's own personnel.

The Department of Commerce holds TWA is guilty on five charges:—

(1) That the pilot of the plane had not taken his routine quarterly physical examination and, after being absent from the Los Angeles-Kansas City run more than six months, had gone back to flying it without first obtaining the required approval of the Bureau of Air Commerce.

(2) That the co-pilot did not hold the special "blind flying" rating required for this particular route.

(3) That the plane did not carry sufficient fuel reserve to fly the required forty-five minutes after reaching the first emergency landing field beyond Kansas City (Kirksville, Mo., 120 miles away).

(4) That the Kansas City dispatcher failed to act on weather information in his possession, which should have caused him to stop the ship at Wichita for fuel and further instructions.

(5) That the pilot ignored a regulation about flying over or through fog when he failed to land at the nearest intermediate airport after the transmitter of his two-way radio went out of commission.

Jack Frye, president of TWA, fires straight back with the statement that the public hearings on the crash "definitely established the fact that the real cause of the accident was that Pilot Bolton . . . attempted to come down through a ceiling reported by the Bureau of Air Commerce observer as 7,000 feet with four miles visibility and lower scattered clouds at 1,200 feet" when actually the conditions were zero-zero.

The seriousness of this controversy cannot be overestimated. It goes right to the heart of the Government's system of regulating the aviation industry. If TWA's contentions are correct, they expose a heretofore hidden disease gnawing at the vitals of America's air transport, the disease of politics in its most hideous form—face saving. But even if TWA is utterly wrong, this exchange of verbal blows poses a question which, although it has escaped notice thus far, must now be answered for the good of both the industry and the United States Government. That question is—Can a Government agency sit in judgment upon an activity in which it itself participates?

The public would not tolerate such duality for one minute in a civil or criminal court. They know instinctively that they could not trust such a court to hand down fair, impartial decisions. It would be as though the Supreme Court joined Congress in drafting the laws of the land and then sat in judgment upon their constitutionality.

Ridiculous, you say! Yet that is almost exactly the position of the Bureau of Air Commerce today. As Secretary Roper suggests in his statement on the accident, the Department of Commerce is charged with establishing and operating aids to navigation, drafting aviation regulations and deciding when, as and if those regulations are being properly observed. Superficially, there seems to be no conflict of functions there. And, in fact, during the years under Assistant Secretaries MacCracken and Young, there *was* no conflict. There was sincerity, not politics, in the Aeronautics Branch in those days. Every official worked so earnestly, so honestly for the advancement of aviation that it was well nigh sacrilege even to whisper criticism of the Department of Commerce; the industry knew it could depend upon getting a square deal.

Whether for real or imaginary reasons, that confidence in the Department no longer exists. There is a wide-spread suspicion that many of the higher officials of the Bureau of Air Commerce are more intent on building themselves up politically than upon building up aviation. There are constantly recurring rumors that bitter dissention and jealousy exist between members of the Bureau's own family. There are memories of implied threats to ride rough shod over the industry in order to accomplish the Bureau's own ends. There is the still lurking feeling that the Bureau had too much to do with the air mail cancellation.

Under such circumstances, it is almost inevitable that the aviation industry should distrust the Department. And with that distrust, it is equally inevitable that the Bureau's administrative and judicial functions should arise in conflict.

If for no other reason than this, it is a good thing the TWA crash is going to be made the object of a Senate investigation. Odious as such interrogations usually are, there is no other way to get to the bottom of this problem. Yet get to the bottom of it we must. For if this infection is allowed to go untreated, if it is allowed to fester and spread its poison throughout all civil aviation, the industry will be weakened forevermore, and the Government will lose prestige that it can never retrieve.

In addition to this comprehensive question of whether any Government department can be both the judge and an accomplice in the act being judged, the TWA accident report warrants investigation on more immediate counts. Jack Frye's counter-attack alone is enough to suggest that something is amiss somewhere. Is the Bureau trying to cover up its own tracks? This isn't the first time, you know, that Bureau operators have been accused of sending out grossly false weather reports.

Besides, the statements of both the Secretary of Commerce and the Director of the Bureau of Air Commerce are not the kind to quell all suspicion for the very reason that they seem to be trying so hard to quell suspicion. Both the Secretary and the Director dwell at great length on all the fine things the Department is doing for aviation. Both proclaim—the Director begins by proclaiming—that the Department of Commerce personnel is absolutely guiltless. With such insistent denials, one can't help at least thinking with Shakespere—"Methinks thou dost protest too much."

Let us not be misunderstood. We do not accuse the Department of Commerce of playing false in this case. We have no right to, for we have not read the testimony taken at the Crash Board's public hearings. But we do believe—and repeat—that the circumstances surrounding this report forbid that the matter be dropped before the whole truth has been aired. The public deserves that consideration. The aviation industry deserves it. Yes, even the Department of Commerce deserves it. For without it the Department's effectiveness in governing the industry will be weakened beyond redemption by suspicion and distrust, if the Bureau is guiltless. And if it is guilty, then it is high time we knew it.

Personairlities

By Caldwell

● HE HAS flown the Atlantic from New York to England non-stop, and the Pacific non-stop from Japan to the U. S., one of the greatest ocean flights to date, 5,300 miles. He has flown non-stop from Porto Rico to Miami, 1,100 miles, and has flown 1,400 miles over the Bay of Bengal. He has crossed the North Japan Sea, the South China Sea, the Caspian Sea, Adriatic Sea, Ionian Sea, Aegan Sea, Java Sea, Timor Sea, Lake Baikal, the Great Lakes, the Florida Straits, the Gulf of Carpentaria, and other large wet bodies of water. When he ran out of water he kept on going over land. He has spent over 14,000 hours in the air, and his name is Clyde "Upsidedown" Pangborn—Pang for short. He is one of the most experienced, daring, and resourceful pilots in the world; and he looks and talks like a bank clerk. In a group of a dozen pilots, any one of eleven of them will make more noise than Pang does. He isn't half as loud as Roscoe Turner's trick uniform.

Clyde Edward Pangborn landed in Douglas County, Wash., Oct. 28, 1896, and by 1914 had graduated from high school and was at work in the forestry service; it was his duty to prevent beavers and Sunday picknickers from gnawing down the trees and leaving tin cans and empty olive bottles on the greensward, as is their custom. As there was no radio in those days, he was spared hearing Joyce Kilmer's "Trees" six times a week.

Clyde timed his war service adroitly, enlisting as a flying cadet Dec. 19, 1917, and emerging as a Second Louie in the air service, just in time to celebrate the Armistice and become an instructor at Ellington Field, Houston, Texas. By Mar. 20, 1919 it became certain that war would not break out again until the Americans had rested up and had saved up enough money to finance another war on credit for the Europeans; so Clyde unloosed himself from the back of the American taxpayer and landed upon the hard ground of commercial aviation, where he took root and has been flourishing ever since.

For three years following that peaceful Texas sortie he was vice-president of the Pangborn Aircraft Co., barnstorming in California, and occasionally flying for Ivan Gates, who, with Lowell Yerex, had been putting on circuses in those parts. Among his relics is a poster advertising an air circus for Coronado, May 16, 1919, which reads: "AIRDEVIL PANG, Aerial Acrobat in a Hurricane of Thrills. Boarding a swooping airplane while in Mid-air. From a Racing Automobile." The swooping airplane was swooped by Ralph Reed, now Operations Manager for United at Omaha. On the first attempt (and this was probably the first auto-to-plane change) Pang was successful. But on the second exhibition Reed flew too fast, and when Pang grasped the ladder it was pulled out of his hand. He crashed to the ground, cracking both shoulders, a wrist, and three vertabraes in his backbone as he bounced and bounded along the ground like a Communist at a Legion rally. They took him to a hospital where he gradually grew together again. In 1922 he became a partner and Chief Pilot of the Gates Flying Circus, one of the most remarkable flying organizations the world has ever seen.

Clyde Pangborn

Among pilots still living who have been members of the Gates Circus for a year or more are Cloyd Clevenger, (who now runs an airline down in Mexico) Lowell Yerex, Tommy Thompson, and Okey Bevins. Eddy Brooks was with them for two years; and Bill Brooks and Warren Smith for three; Pang himself was with the Circus for nine years. Pilots now dead are Bill Brock, Freddy Lund, Wilmer Stultz, Roy Ahern, Ned Carrington, and two named Cecil and Tallman, whose first names Clyde cannot remember. They were with the Circus a year or more. Harold McMahon spent two years with the Circus, Buck Steele three years, and Ive McKinney and Jack Ashcraft four years. Oddly enough, all of these pilots were killed or died after they had left the Circus. Only parachute jumpers and wing walkers were killed with the outfit. Jinks Jenkins, Wesley May, and Red Jackson were killed when their parachutes failed to open. (These early exhibition 'chutes must not be confused with the excellent modern parachutes.) George Walker and Jack Parks fell off the plane while wing walking, making five in all who were killed in action. Parachute jumpers and wing walkers still living include Aaron Krantz, the greatest of them all, Milton Girton, Shorty Bittner, Vance Breese, and Mickey Efferson. All but Efferson now are crack pilots, and have been for years.

The Gates pilots and stunt men were a daring group, performing stunts at low altitudes which would cause a Department of Commerce inspector to-day to call out the police and the National Guard. Also they promoted aviation in every state of the Union, and carried from 90,000 to 175,000 passengers a year. If they terrified some, they introduced countless others to the air—nearly a million passengers in all! Some days they would make over 300 take-offs and landings per ship, with four passengers on each hop. One day in Lewiston, Maine, Bill Brooks carried over 1,300 in a Hisso Standard, four passengers per trip. Many a day Pang carried 1,000 passengers.

Chatting with Pang the other day in his suite at the Hotel Gotham, New York, was Mickey Efferson, who in addition to his wing-walking and plane-changing used to do engine repairs and ticket selling for the Circus. His spiel went: "We have high rides and low rides, long rides and short rides, straight rides and stunt

(*Continued on page* 116)

EDITORIALS

"American industry is ready for another forward surge. It is probable that more technical progress has been made during the depression than in any other equal period of time. The real impetus will first be felt when each industry avails itself of all the help which all other industries now have to offer. This help can come only through a stripping away of side-issues, and a clear understanding of fundamentals."—E. L. ANDREWS, Vice-Pres., Fuller & Smith & Ross, advertising agents for the Aluminum Co. of America.

A Tribute to Men In Allied Industries

● If it were possible to express engineering achievement in numerical terms, we might illustrate such progress in a convincing manner by means of charts on the order of those prepared by statisticians in the business and financial world. Unfortunately, there are too many factors of indeterminate value connected with engineering work to ever become so specific, and we must be content, for the most part, to evaluate as best we can from the results which come to our attention.

It so happens that comparatively few ever have the opportunity to observe what is being accomplished in the various fields of engineering. Among those who are afforded this privilege, we suspect that not many fully comprehend and appreciate that vast resourses and talents are represented. In the case of mobile vehicles, for instance, one is apt to be more interested in performances or records than the real story behind the development. Such stories frequently seem dull to those who do not grasp the meaning of technical phraseology or fully understand the aims and purposes of engineering projects.

These circumstances satisfactorily explain why the romance in engineering is practically unknown except to those actually engaged in it. Moreover, they account for some of the reasons why the engineer seldom comes in for much personal glorification—which, perhaps, is as it should be. The nature of engineering work hardly fits one tempermentally for public acclaim, at any rate, not the sort which manifests itself in the news-reels.

Now, there really is no intention in the above comments to imply that we should expect one who has no technical training or experience to develop a keen sense of appreciation in matters pertaining to engineering, nor to picture the engineer as always being a modest and retiring fellow whose talents go unrecognized. After all, these are just statements of simple truths which serve rather well—by way of introduction—to bring us to the theme to which this issue of Aero Digest is dedicated.

In several of the articles which follow, we will note the engineering progress resulting from the close relationship between the manufacturers of aircraft and engines and the vendors which supply various parts and materials of construction. And, in dealing with this particular phase of the development of aircraft and engines, the latter being the most highly-refined and efficient mechanism employed anywhere in the transportation field, we especially aim to award due credit to those engineers and craftsmen, together with the industries which they represent, that have assisted the engine manufacturer in such an effective manner.

There was a time, during the early development period of the aviation industry when the engineer had to design every part that went into the product he was building. He could not purchase carburetors, magnetos, spark plugs and struts, tie rods, and fittings as he has during the past several years. In many cases, the designer was required to produce his own patterns and castings, as well as fabricate other parts with unsuitable equipment, because there were no specialized sources of supply.

It is evident that the organizations which now produce auxiliaries, or rough and finished materials in various forms, have grown primarily as a result of the broad acceptance of the internal combustion engine for automotive, marine and stationary purposes. Aircraft, too, has contributed toward the growth of these specialized industries, but only of late (the period of the World War excepted) has the volume of business become a factor of much importance.

A survey at this time would not disclose that very many manufacturers depended solely upon the parts and materials supplied to the aircraft trade. In many cases, this class of goods may represent only a small portion of the annual output, and perhaps an even smaller portion of the profit, if any.

Thus it appears that the manufacturers to whom we refer have shown a great deal of faith in the future of aviation, especially since they do not seem to have been greatly concerned about immediate profits. No matter how sporting this attitude may appear, it does not deserve so much credit as such (in view of the rapid growth of the aviation industry) as the business acumen which has been displayed.

Another Record Is Established

● Five years ago, when the Hunter brothers set an official record for endurance, remaining in the air nearly 554 hours, they established a mark which was conceded to be a most difficult one to exceed for some time. Al Key and his brother Fred of Meridian, Mississippi, have just bettered this performance by remaining aloft 27 days 5 hours and 34 minutes, or for a period of time sufficient to have enabled them to make a continuous flight equal to twenty round trips from coast to coast in a modern transport. By the achievement of their plane, which (because of the nature of the flight) had neither the extensive service that every airliner gets as a matter of routine procedure, the appreciation of American pilots, aircraft and engines has been raised not only in the eyes of the aeronautical world but more practically in the estimation of the travelling public.

Cleared But Reprimanded

● Last month Secretary of War Dern cleared Major General Benjamin D. Foulois, Chief of the Army Air Corps, of charges preferred against him by the House Military Affairs Committee, but reprimanded him for his testimony before the investigating committee.

We know that General Foulois could never have been guilty of all the charges made against him in the case. His love for the Army Air Corps is borne out by the fact that he has spent the best years of his life in it.

Much aviation history has been written since General Foulois had *foresight* enough to invest his own funds in an airplane to demonstrate that aviation was the future weapon of national defence.

In the long years since then, the General has seen his convictions and his prophesies realized. He has grown up with the service, assimilating a knowledge of aviation and its capabilities which have stood him in good stead in his dealings with the Army Air Corps.

Listening to some of the younger officials who care nothing about aviation must have been very trying to a man who knew, a generation ago, more about aviation, as well as loyalty, than many of his investigators will ever know.

DR. ALEXANDER KLEMIN
GLENN D. ANGLE

AVIATION ENGINEERING

DR. MICHAEL WATTER
DR. MAX MUNK

Heat Treatment of Metals Used in Aircraft

HORACE C. KNERR

Consulting Metallurgical Engineer; President, Metallurgical Laboratories, Inc. (Metlab) Phila., Pa.; Director, Metallurgy Course, Temple University; Formerly Chief Metallurgist, U. S. Naval Aircraft Factory.

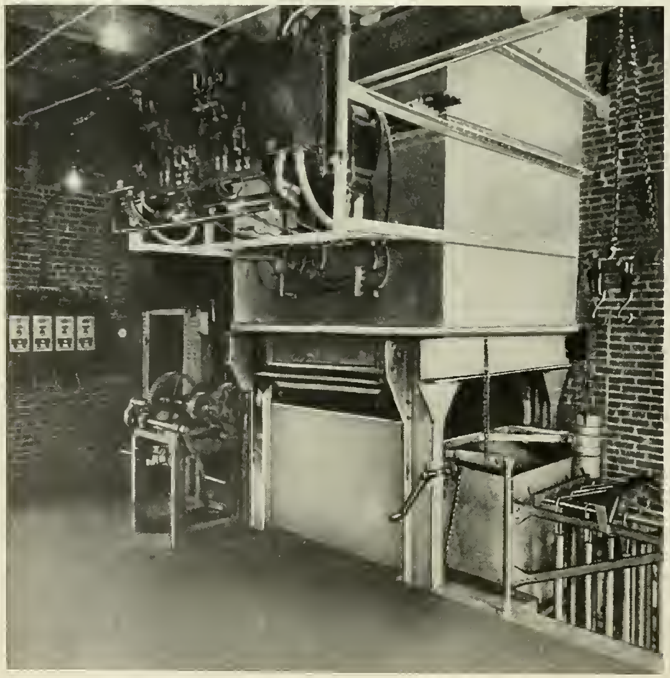
● The heat treatment of aircraft members, either of steel or of duralumin, is much more exacting than the treatment of ordinary mechanical parts. Since the greater part of the strength of the member is the result of heat treatment, every inch of every member must be correctly and uniformly treated.

Forgings, bolts, and engine parts are most frequently heat treated by the manufacturer of those parts. In the majority of cases, the required strength is only about 150,000 lbs./sq. in. This permits heat treating in the rough or semi-finished condition, final machining being done after heat treatment—a desirable method where it can be applied, because all questions of surface condition and of deformation due to heat treatment are eliminated. The heat treatment of such parts is about the same as that of automotive parts, and can be handled on a production basis in continuous furnaces if quantities warrant. To avoid the possibility of defective material or heat treatment, every single part should be tested by some means, such as a Brinell, Rockwell or Scleroscope hardness test, or by a magnetic method.

Small steel structural parts, such as fittings, forgings, and the like, can very well be heat treated in the aircraft manufacturer's own shop in a suitable small furnace, provided a competent man and reliable pyrometric equipment are available. Such a furnace is preferably fired with gas or electricity, may be one to two feet wide and two to three feet long, and will accommodate a great variety of small work.

The heat treatment of the larger structural parts of aircraft, such as landing gear, wing beams and the like, due to their tubular nature and complicated form, thin wall, and frequently great length, presents an exceedingly difficult problem for heat treatment by ordinary methods. Accuracy of dimensions is essential. In duralumin, some correction for deformation can be made while the metal remains plastic. In steel, deformation during heat treatment must be eliminated, because little or no straightening is possible afterwards. Special equipment is therefore required. The ordinary commercial heat treating shop is seldom prepared to handle such work. This is also true for duralumin.

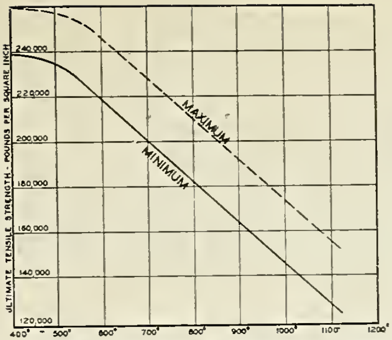
Special furnaces have been designed for the heat treatment of large steel structural parts of aircraft. One of these furnaces is illustrated below. The



Vertical heat-treating furnace used by Metallurgical Laboratories, Inc.; (right) Stinson Airliner landing gear heat treated to 180,000 lbs./sq.in. The size of the unit is shown by comparison with the cigarette package at the left.

The furnace consists of an inverted pit or well, the opening being at the bottom. The parts to be treated are first suspended in a vertical position, free from tendency to sag or deform under their own weight, from a spider made of a heat-resisting alloy. The spider is next moved, on a carriage, directly under the furnace door. Two rods are lowered through stuffing boxes in the top of the furnace, engage with the spider and pull it up, drawing the charge into the furnace. Here it hangs vertically during heating. The furnace is divided into a number of horizontal zones, each zone being separately controlled, so that uniformity of temperature from top to bottom of the furnace is secured. There is a duct in the wall of the furnace connecting the top and bottom, which permits active circulation of furnace atmosphere, thus contributing greatly to uniformity. One of these furnaces is 10 feet high and 3 feet square, inside, for treating landing gear and other bulky parts, while another is 25 feet high and 2 feet in diameter for wing beams, long struts and tubes.

When the work has been heated to the proper temperature for the required time, the quench tank, also mounted on the aforesaid carrier, is rolled directly under the furnace opening. The furnace door is moved to one side and the work is then lowered straight down into the quench tank, rapidly but under control. The rods are disengaged and drawn up. The tank is then moved to one side while the work continues to cool in the oil. By this time another charge has been placed on a second spider, on the bracket at the side of the quench tank. It is now brought under the furnace opening, picked up on the rods and drawn into the furnace. The furnace door is then closed, and heating proceeds. The quenched charge is raised out of the tank by a hoist, and the oil allowed to drain off. The work is removed from the spider and laid aside. On the following day the temperature of the furnace has cooled somewhat and is brought to the correct heat for the tempering operation. The work is replaced on the spider, drawn into the furnace, tempered for the right time, and lowered out in the air.



Tempering temperature in degrees F of 4130X steel tubing .032—.25" thick, oil quenched from 1600-1625° F.

Test specimens representing the material are attached to every lot of work, at several points from top to bottom. These go through heat treatment with the parts and are afterward pulled to verify that tensile requirements have been met.

The method of suspending the charge vertically in the furnace, holding it vertically while heating and quenching vertically, is the secret of avoiding distortion in these long slender members. If a delicate part is laid in an ordinary horizontal furnace, it sags under its own weight during heating. Attempts to prevent this by blocking up are seldom successful. When the part is picked up at the quenching temperature, it is in a plastic condition, and sags again, this time in a different direction. When it strikes the quenching medium sideways, further warping occurs. After all this warping, it is usually impossible to use the piece.

Quenching by lowering out of the furnace directly into the oil beneath seems to secure an unusually high combination of strength and ductility. The work has no time to cool unevenly and every portion is at the same temperature when it strikes the oil. The oil is caused to circulate, the hottest overflowing at the top of the tank into a sump tank beneath, in which there is a cooling coil, carrying water. The cooled oil is then pumped back into the bottom of the tank and travels upward.

It would cause too much delay to cool the furnace down to a low temperature when introducing each charge. Instead, the work is drawn slowly up into the furnace, allowing perhaps one-half to one hour preheating time. While the door is open, the bottom of the furnace is

Showing toughness of heat treated 4130X steel; stub ends of heat treated tensile specimens, edges rounded, bent cold over radius equal to thickness of material; (right) Two Westinghouse electrical furnaces for small parts

cooler than the top. This provides a gradual and uniform preheating, and avoids strains which would result from heating too suddenly.

The best quenching temperature for 4130X steel is 1600° to 1625° F. One of the characteristics of this material is that it permits a rather wide quenching range so that even a somewhat greater variation of temperature has no harmful effects.

The tempering temperature is regulated to suit the tensile requirements. The graph illustrates the temperatures used in practice for a variety of tensile strength values. The variation of chemical composition of the steel, even though held within the type analysis limits, results in a variation in tensile strength after heat treatment. It is therefore impossible to hold to exact tensile values. It is customary to heat treat the material to exceed a given minimum of tensile strength and at the same time to meet a minimum requirement for elongation. Therefore, while the tensile strength may be as much as 10% or 15% higher than specified, the elongation must always be ample, so that adequate ductility is assured.

The thickness of the specimen has a great effect on elongation value obtained. Thin specimens, after identical heat treatment, show very much smaller elongation values than thick specimens of the same tensile strength. Army and Navy specifications recognize this condition, which is due to geometric effect, and a lower elongation value is accepted for thinner materials. To prove that these thin specimens of "low" elongation are no less ductile than the thick ones, a sample of the material having its edges smoothly rounded is bent over a radius equal to its thickness. Even at tensile values as high as 200,000 lbs./sq. in., it is possible to bend such a specimen nearly 180° without fracture.

Heat treatment of duralumin, being so closely associated with the fabricating process, must usually be done in the aircraft shop. An open furnace of any type may be used, provided temperature control is uniform, but a molten salt bath is preferable because it saves time.

Molten sodium nitrate, contained in an ordinary steel tank with welded seams, is heated by means of oil, gas or electricity. Heat should be applied low on one side, not to the bottom of the tank, otherwise the bottom will burn through when sludge accumulates, or will burst on remelting the solidified salts. Convection currents provide good circulation and therefore uniform temperature, but stirring may be necessary if the tank is crowded with work. Aluminum alloys are very soft at heat treating temperature, 930° to 950° F. and must be carefully handled, in iron baskets if small, or from iron wires at numerous points if large.

Quenching in cold water produces the best resistance to corrosion, but the most distortion. Milder mediums such as oil or air will give nearly as good physical properties and much less distortion. Quenching must be prompt after removal from the furnace or bath.

By quenching duralumin from vertical furnaces as above described, into oil, very little distortion occurs and much straightening labor is saved. If Alclad is used (duralumin with a thin coating of aluminum for corrosion protection) the results are most satisfactory from every standpoint.

Process specification SR-53a, Bureau of Aeronautics, Navy Dept., gives excellent instructions and much detailed information for the heat treatment of aluminum alloys of the duralumin type.

It goes without saying that in all heat treating operations, whether for steel or duralumin, it is very necessary to have accurate and reliable pyrometric control. The mere reading of a pyrometer does not insure that the work is at correct temperature. The location of the thermocouple, as well as its accuracy, and the accuracy of the instrument must all be right. The thermocouple can at best only register the temperature at its end. If the heating chamber, either a furnace or a slat bath, is not at uniform temperature throughout, the work may be spoiled. Badly designed furnaces may show uniform temperature when empty, but be very uneven when a charge is in place. Duralumin is completely ruined if heated only slightly above its optimum quenching temperature. The effect on steel is much less serious but physical properties are impaired.

The heat treatment of aircraft parts is a specialized operation which should be supervised and carried out by persons thoroughly trained and experienced, who understand the metallurgical problems and also appreciate the extremely exacting requirements of aircraft construction.

Recent Aeronautical Patents

The following patents of interest to readers of AERO DIGEST recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Adjusting gearing for variable-pitch propellers. Heinrich Ebert, Frankfort-on-the-Main, Germany. (1,999,091)

Autorotative-winged aircraft. Juan de la Cierva, Madrid, Spain, assignor to Autogiro Co. (1,999,136)

Propeller for aircraft and like purposes. Archibald G. Forsyth, Cheam, England, assignor to Fairey Aviation Co., Ltd., Hayes, England. (1,999,326)

Airplane wing structure. Earl J. W. Ragsdale, Norristown, Pa., assignor to Edward G. Budd Mfg. Co. (1,999,372)

Arrangement for producing illuminated advertisements on airplanes. Otto Reder, Berlin, Germany. (1,999,479)

Combination aileron and wing flap. Williams T. Rouse, Arlington, Tex. (1,999,528)

Aircraft with rotatable sustaining means, and aircraft having sustaining rotors, Joseph S. Pecker, Philadelphia, Pa., assignor to Autogiro Co. (1,999,636 and 1,999,737)

Aircraft pick-up mechanism and method. George M. Palmer, St. Paul, Minn. (1,999,777)

Aircraft having rotative sustaining blades or wings. Agnew E. Larsen, Huntingdon Valley, Pa., assignor to Autogiro Co. (1,999,840)

Automatic variable-pitch propeller. Lester M. Taylor, Dayton, Ohio. (2,000,049)

Aeronautical machine. John A. Domenjoz, New York, N. Y. (2,000,068)

Aircraft. Robert R. Osborn, Garden City, and Theodore P. Wright, Port Washington, N. Y., assignors to Curtiss Aeroplane & Motor Co. (2,000,666)

Rotary winged aircraft. Joseph S. Pecker, Philadelphia, Pa., assignor to Autogiro Co. (2,000,904)

Gyroscopic indicator for use for air and other craft. George H. Reid, London, England. (2,001,038)

Flying machine. Richard H. Sears, 2d, and James F. Koca, Woodstock, Ill. (2,001,158)

Airplane sign. Bernard Knapp, Kansas City, Mo. (2,001,200)

Construction and arrangement of airplane wings. James Martin, Higher Denham, England. (2,001,260)

Airplane. George A. Shawberger, Shaw, Oreg. (2,001,400)

Rotor for helicopters. Claude Dornier, Friedrichshafen-on-the-Bodensee, Germany. (2,001,529)

Retractable landing gear for airplanes. Rene L. Levy, Mountrouge, France. (2,001,620)

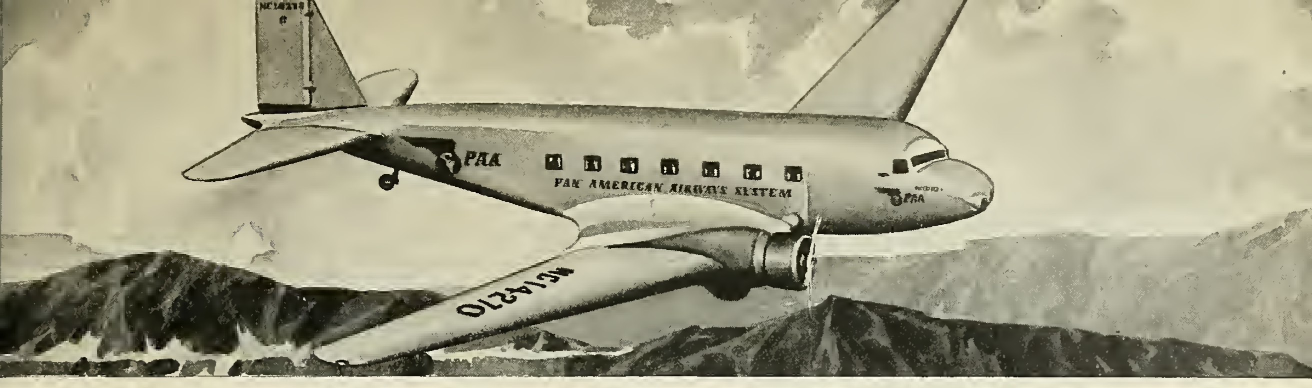
Aircraft. David Gregg, Caldwell, N. J., assignor to Bendix Research Corp. (2,002,057)

Flying machine. Anton Flettner, Berlin, Germany. (2,002,287)

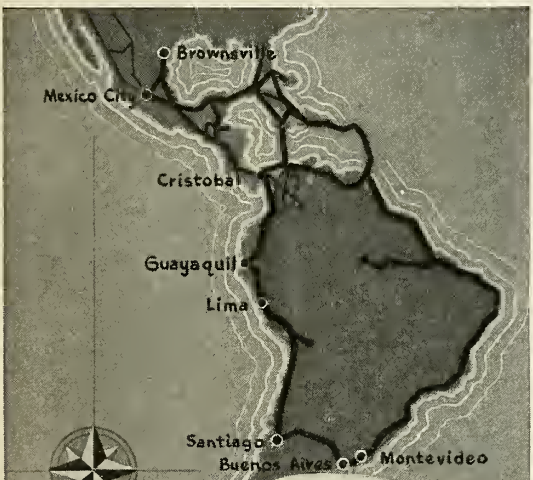
Airplane. Samuel Sera and John Hatala, Erie, Pa. (2,002,299)

Airplane steering mechanism. Harry A. Douglas, Bronson, Mich. (2,002,528)

Airplane. Jacob Hojnowski, Nekoosa, Wis. (2,002,740)



WRIGHT CYCLONES *Speed Travel on the Airway to* CENTRAL *and* SOUTH AMERICA



Pan American Airways System provides the world's fastest international transportation to Central and South America—serving 170 cities in 32 countries and colonies.

Wright Cyclones power the 210 mile-per-hour Douglas Airliners now in operation on Pan American's division from Brownsville, Texas, to Panama, via Mexico City. Cyclones also power the new Pan American-Grace schedules from Guayaquil, Ecuador, and Lima, Peru, to Buenos Aires, Argentina, and Montevideo, Uruguay—along the west coast of South America to Santiago, Chile, and across the Andes Mountains.

The luxurious new Pan American Airways planes are similar to the TWA Douglas transports that speed overnight from New York to Los Angeles . . . flash between Chicago and New York in 4½ hours on American Airlines . . . and span the distance between New York and Miami in 8 hours, via Eastern Air Lines.

Wright-powered equipment is also operated by the Pan American Airways System on its divisions in Alaska (Pacific Alaska Airways, Inc.) and in the Far East (China National Aviation Corporation).

WRIGHT

AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION

Non-Ferrous Metals in Aircraft and Engine Construction

●

J. B. JOHNSON
Chief, Material Branch, U. S. Army Air Corps

● All metals and alloys in which iron is not the basic element are classified as non-ferrous. Non-ferrous alloys are used extensively in airplane and engine construction because of their inherent characteristics such as density, corrosion-resistance, ease of fabrication, electrical and thermal conductivity, and frictional resistance which permits more satisfactory and economical design.

Many of these properties may be attributed to the pure base metals, although some are appreciably changed by the addition of alloying elements. The moduli of elasticity and rigidity are generally least affected, and the density can be calculated with sufficient accuracy for engineering purposes from the percent-

ITEM	SPECIFICATION NUMBER						MATERIALS	HEAT-TREATMENT									NOMINAL CHEMICAL COMPOSITION									
	U.S. GOVERNMENT				SAE.	MFRS. (1)		SOLUTION		QUENCH	AGING		ANNEALING		STABILIZING		COPPER	SILICON	MANGANESE	MAGNESIUM	NICKEL	ALUMINUM	TIN	ZINC	LEAD	OTHER ELEMENTS
	SHEET	BARS AND RODS	TUBES	FORGINGS AND CASTINGS				TEMP °F.	TIME HOURS		TEMP °F.	TIME HOURS	TEMP °F.	TIME HOURS	TEMP °F.	TIME HOURS										
1	QQ-A-561(2)	QQ-A-411	WW-T-783		25	2S½H	Commercial Pure Aluminum						625 700									99.0				
2	QQ-A-359	QQ-A-356	WW-T-788		29	3S½H	Aluminum Manganese						625 775						1.25			97.0				
3	47-A-9(3)	46A8	11069(4)		20	4S	Aluminum Manganese Magnesium						625 775						1.15	1.15		97.0				CHROMIUM
4				57-153	28	51ST	Silicon-Magnesium Forgings	960 980	5	CW	320	18						1.0		0.6		97.0				0.25
5	47-A-11					52S	Aluminum-Magnesium Chromium												0.1	2.5		94.0				0.25
6A	QQ-A-353	QQ-A-351	57-187-2(4) WW-T-786	57-153	26	17S	Duralumin	925 950	1	CW	Room		650 800				4.0		0.5	0.5		94.0				
6B	57-152-2				26	17S	Duralumin Sheets (Alclad)	925 950	1	CW	"						4.0		0.5	0.5		94.0				
7A	11066	11071	57-187-2 10235		24	24S	High Magnesium Duralumin	910 930	1	CW	"		650 800				4.2		1.6	1.5		93.0				
7B	11067				24	24S	(Alclad)	910 930	1	CW	"						4.2		1.6	1.5		93.0				
8				57-153	27	25S	Aluminum Alloy Forgings	960 980	1	CW	275 300	12	700 800				4.5	0.8	0.8							
9						14S	Aluminum Alloy Forgings	925 950	1	CW	275 300	12					4.4	0.8	0.75	0.35		92.0				
10				57-153		27S	Aluminum Alloy Forgings	960 970	1	CW	300 350	12					4.2	0.8	0.8			95.0	0.04			
11						32S	Aluminum Alloy Forgings	950 980	12	CW	300 350	12					1.0	12.0		1.0	1.0	87.0				
12						18S	Aluminum Alloy Forgings	940 960	5	CW	385 400	5					4.0			0.5	2.0	93.0				
13				11309	324	220	Sand Castings													10.0		90.0				
14				57-72-5A	38	195	Sand Castings	925 950	24	CW	275 300	2			400	15	4.5	1.2	0.3			92.0				
15				11308	323	356	Sand Castings	980 1010	16	CW	300 320	2			440	8	0.2	7.0		0.3		91.0				
16				11307	322	355	Sand Castings	960 980	16	CW	285 310	5			440	8	1.2	5.0	0.3	0.5	0.3	92.0				
17				57-72	35	43	Sand Castings											5.0				94.0				
18				57-72-4	320	214	Sand Castings											0.4	0.6	3.75		95.0				
19				57-72	34	122	Permanent Mold Castings										10.0			0.2		88.0				
20				57-72-1	39	142	Permanent Mold Castings	925 950	16	CW	350 375	5					4.0			1.5	2.0	93.0				
21				57-72	30	12	Sand Castings										8.0					90.0				
22				57-93-1	307	85	Die Castings										4.0	5.0	0.3		0.5	87.0				
23					305	13	Die Castings											12.0				87.0				
24						F	Magnesium Aluminum												0.3	95.0		4.0				
25						M	Magnesium Manganese												1.5	98.0						
26						J	Magnesium Aluminum-Zinc												0.2	92.0		6.5		0.75		
27						G	Magnesium-Aluminum Castings	800 820	16	CW	275 300	16							0.1	89.0		10.0				
28	QQ-C-501		WW-T-799	Wire 57-222-1			Copper Soft										99.9									
29	QQ-B-611		WW-T-791	QQ-W-321			Brass																	37.0	3.0	
30	QQ-B-636						Naval Brass Bars-Sheets										60.0						0.75	38.0		
31		57-162-1					Special Naval Brass Bars-Rods										61.0						0.75	38.0		
32	QQ-B-121						Manganese-Bronze Bars-Sheets										59.0		0.5			0.25	0.75	39.0		Iron 0.5
33				QQ-B-726			Manganese-Bronze Castings										58.0		3.5			1.5	1.5	40.0		
34		QQ-B-666					Aluminum-Bronze Bars-Sheets										88.0				0.25	8.0				4.0
35				QQ-B-671			Aluminum-Bronze Castings	1650 1675	1	CW	800 1000	1					85.0					10.0	0.2			1.0
36							Aluminum-Bronze Castings										77.0				5.0	10.0				5.0
37		QQ-B-746					Phosphor-Bronze Bars-Sheets										94.0						3.5	0.3		Phosphorus 0.2
38				QQ-B-691			Phosphor-Bronze Castings										82.0						8.0	0.2	8.0	0.4
39		11070					Beryllium-Copper Bars-Sheets	1425 1475	2	CW	520 530	2					97.0				0.3					Beryllium 2.2
40				11070			Beryllium-Copper Castings	1425 1475	2	CW	520 535	2					97.0				0.3					2.2
41		QQ-B-691		A 11306			Bronze Castings										85.0						5.0	5.0	5.0	
42		QQ-B-691		B 11306			Bronze Castings										88.0						6.0	4.0		
43				D 11306			Lead-Bronze Castings										72.0								28.0	
44		QQ-C-541					Monel										23.0	0.5	3.5		60.0	0.5				Iron 3.5
45		10082					Inconel										1.0		1.0		70.0		Chromium 15.0			10.0
46	11065		57-192-1				Copper Silicon										95.0	3.0	1.0							
47		Type E QQ-R-571					Welding Rods											5.0				92.0				
48		B QQ-S-571					Tin-Lead Solder																45.0		55.0	
49		QQ-S-561					Silver Solder										30.0							25.		Silver 45.0
50		QQ-S-551					Spelter											80						20		
51		57-99-1					Lead-Silver Solder																		95.0	5.0

ages of the principal elements forming the alloy. The addition of alloying constituents lowers the electrical and thermal conductivity of the pure metal. The effect on the other properties can rarely be predicted, and as a result a vast quantity of data has been acquired. Unless these data indicate properties which can be obtained consistently and economically on production alloys they have no particular value for engineering design.

Table II

	Specific Gravity	Melting Point Deg. F.	Coefficient Expansion 60-600° F.	Thermal Conductivity	Modulus of Elasticity	Modulus of Rigidity	Electrical Resistivity at 20° C Microhms/CM³
Aluminum	2.70	1220	.000026	0.52	10,000,000	3,850,000	2.69
Magnesium	1.74	1200	.000028	0.37	6,250,000	2,200,000	4.46
Copper	8.93	1982	.0000177	0.92	17,000,000	6,500,000	1.72
Nickel	8.9	2645	.0000145	0.14	31,000,000	10,000,000	6.93

Mechanical Properties

The majority of the data given in Table I are taken from specifications and represent the minimum values for material produced in commercial lots. The mechanical properties of non-ferrous metals can be modified by thermal treatments and strain hardening such as cold rolling, hammering, spinning and drawing. Commercially pure metals respond very little to thermal treatments except annealing to remove the effects of strain hardening. Many alloys are in the same category, Items 2, 3, 5, 24, 25, 26, 29, 30, 37, 45 and 46, and a range of physical properties for these alloys from the soft annealed condition to the full hard is given in the detailed specifications, but for the purpose of comparison only the properties of the half hard materials are listed in Table II. These data are for ½″ round bars, except for those items which are manufactured in the form of sheet only, in which case the values are for sheet 0.031″ in thickness. The tensile strength of strain hardened metal is generally lower for larger bars and thicker sheet and higher for thinner sections. The mechanical properties for heat-treated material are not so dependent on size. Heat-treated materials can also be strain hardened after heat treatment with an increase in tensile strength and ratio of yield strength to tensile strength. The ductility, however, is generally reduced so that these materials can only be used for parts requiring relatively slight bending or forming operations.

The properties of castings depend not only on chemical composition and heat-treatment but also on melting and pouring temperatures, section thickness, type of mold, location of gates and risers and other foundry practices. The tensile and fatigue properties (Table I) were obtained from cast to size specimens; the shear and compression tests were made on specimens machined from ¾″ sand cast bars.

The properties of the forged alloys were obtained from specimens machined from forgings approximately 1½″ in thickness except Items 11 and 12, which

MECHANICAL PROPERTIES								PRINCIPAL USES	ITEM
TENSILE STRENGTH lbs /sq. in.	YIELD STRENGTH lbs/sq. in.	ELONGATION in 2 in. %	BRINELL HARDNESS 500 kg. load	ROCKWELL HARDNESS	SHEARING STRENGTH lbs/sq. in.	FATIG. LMT. ROTNG. BEAM lbs./sq.in. (8)	COMPRESSION STRENGTH lbs /sq.in. (9)		
17,000	14,000	20.0	32	E 32 (6)	11,000	7,000	17,000	Cowling: tanks	1
19,500	17,000	20.0	45	E-51	14,000	9,500	19,500	" "	2
35,000	31,000	10.0	65	E-77	19,000	9,000	35,000	Fuel and Oil lines	3
43,000	34,000	12.0	90	E-85	23,000	10,500	45,000	Cowling; fairing	4
34,000	24,000	5.0	-	-	-	-	-	Minor structural parts	5
55,000	30,000	16.0	100	E-96	35,000	13,000	55,000	Structural parts	6A
50,000	27,000	14.0	-	-	-	-	-	" "	6B
65,000	43,000	20.0	105	E-97	40,000	14,000	65,000	" "	7A
56,000	37,000	14.0	-	-	-	-	-	" "	7B
55,000	30,000	16.0	100	E-96	35,000	14,000	55,000	Propellers; misc. forgings	8
70,000	60,000	10.0	125	E-104	44,000	15,000	70,000	Misc. forgings	9
60,000	40,000	12.0	120	-	45,000	14,000	60,000	" "	10
50,000	40,000	3.0	120	-	38,000	-	50,000	Pistons	11
40,000	35,000	5.0	100	-	-	-	45,000	"	12
40,000	22,000	11.0	85	-	-	7,500	72,000	Airplane misc. castings	13
32,000	18,000	3.0	80	-	25,000	9,000	50,000	"	14
30,000	20,000	3.0	90	E-76	22,000	-	50,000	Wheels; crankcase castings	15
32,000	20,000	1.0	92	-	-	9,000	65,000	Cylinder jackets Engine castings	16
18,000	7,000	6.5	-	-	-	5,000	25,000	Misc. castings low stress	17
21,000	10,000	5.0	50	-	18,000	5,000	45,000	Misc. castings	18
35,000	29,000	1.0	100	-	29,500	-	75,000	Cylinder heads	19
32,000	-	1.0	109	-	24,000	8,000	52,000	" "	20
18,000	14,000	1.5	65	-	20,000	9,000	38,000	Misc. castings low stress	21
32,000	18,000	2.0	60	-	-	-	-	Cover; plates	22
33,000	16,000	1.5	80	-	-	-	-	" "	23
40,000	26,000	15.0	48	E-55	19,000	16,000	50,000	Seats; fairings	24
38,000	28,000	4.0	42	E-40	18,000	7,000	52,000	" "	25
40,000	28,000	15.0	51	-	19,000	15,000	60,000	Misc. forgings	26
35,000	18,000	1.0	-	-	17,000	8,000	50,000	Wheels; misc. castings	27
35,000	-	25.0	-	-	-	10,000	-	Sheathing; fuel lines	28
55,000	25,000	15.0	-	-	-	18,500	-	Misc. machine screw parts	29
60,000	27,000	35.0	-	-	-	-	-	Reflectors	30
62,000	37,000	25.0	135	B-73 (7)	45,000	21,000	70,000	Turnbuckles	31
83,000	57,000	10.0	-	-	-	-	-	Bolts	32
65,000	-	30.0	93	B-90	40,000	17,000	-	Landing gear fittings	33
75,000	30,000	15.0	128	B-104	50,000	34,000	80,000	" ; bolts	34
75,000	40,000	45.0	200 (5)	-	-	-	100,000	Valve guide seats	35
75,000	40,000	40.0	200 (5)	-	-	-	100,000	" " "	36
98,000	90,000	2.5	-	-	-	-	-	Small bearings	37
25,000	-	8.0	60	-	-	-	30,000	" "	38
200,000	160,000	-	400 (5)	-	-	38,000	-	Springs	39
111,000	-	-	428 (5)	-	-	12,000	-	Misc. fittings	40
27,000	-	15.0	50	-	-	-	20,000	Fuel line fittings	41
40,000	-	20.0	70	-	-	-	45,000	Bushings-bearings	42
-	-	-	-	-	-	-	-	Bearings	43
65,000	25,000	35.0	-	-	-	35,000	-	Special tanks	44
85,000	35,000	35.0	-	-	-	-	-	Exhaust equipment	45
50,000	14,000	35.0	-	E-88	-	11,000	-	Fuel lines; segregators	46

NOTE:
(1) Aluminum alloys—Aluminum Co. of Amer.; Magnesium alloys--Dow Chemical Company
(2) Federal specifications (3) Navy specifications (4) U.S. Army & Air Corps specifications
(5) Brinell hardness, 3000 kg. load (6) Rockwell hardness, 1/8 ball, 60 kg. load "E" scale
(7) Rockwell hardness, 1/16 ball, 100 kg. load "B" scale
(8) Fatigue limit at 500,000,000 cycles for all except items No. 14,16,17,18,20,21,39,44, and 46 which are 100,000,000 cycles and 50,000,000 cycles for items No. 29, 31,33, and 34.
(9) Compression approximately 0.05 inch permanent set on 1 inch cube

Table I showing the various types of non-ferrous metals used in aircraft construction

were obtained on specimens machined from piston heads.

Heat Treatment

Heat-treated non-ferrous alloys are of two types, those which contain one or more constituents which have an increased solubility in the base at elevated temperatures, and those in which the crystalline structure changes with temperature in a manner analogous to steel. The aluminum alloys and beryllium alloys represent the former class and aluminum bronze the latter.

The solution temperature as given in Table I represents the temperature at which the constituents have gone into complete or partial solution, or re-crystallization has been effected. Heating may be done in a nitrate bath or air furnace in the case of the wrought aluminum alloys; in an air furnace in the case of cast aluminum alloys and bronzes, and in an inert medium or non-oxidizing atmosphere in the case of the magnesium alloys. The time at the solution temperature depends upon the condition and size of the part. If the part has been worked in rolls or under a hammer less time is required than for a cast material. Small thin pieces require less time than large pieces. The following is given in Air Corps Specification 98-10026 for wrought aluminum alloys.

Thickness of Material (inch)	Minimum time of soaking for solution treatment Air Furnace	 Salt Bath
Up to 1/32	10	10
1/32–1/16	20	15
1/16–1/8	30	20
1/8–3/16	40	20
3/16–1/4	60	20
1/4–1/2	90	30

Quenching is generally done in cold water although for complicated castings hot water or a medium which gives a slower quench may be necessary. A cold water quench in the case of aluminum alloys assists greatly in preventing intercrystalline corrosion.

The aging process carried out at low temperatures generally increases the tensile strength and hardness and lowers the ductility. For example, Item #14 (Table I) as quenched would have a tensile strength of about 28,000 lbs./sq. in. and an elongation of 8%, which may be compared with the properties listed for the alloy after a 2-hour age at 300° Fahr.

The stabilizing treatment is used whenever it is essential that there shall be no change in dimensions after machining as in the case of engine crankcases and cylinder jackets. These treatments tend to anneal the alloys and the tensile strength may be from 25% to 30% lower than the values given in the Table which are for the unstabilized metal.

The aging temperature and time for the beryllium-copper alloys are dependent upon relatively small differences in chemical composition especially if optimum properties are desired.

Corrosion-Resistance

It is essential on account of the light sections that the metal used in aircraft parts shall resist the various corroding mediums to which they may be exposed. The corroding agents are moist air, sea water, gasoline containing water and ethyl fluid, products of combustion of leaded fuels and chemicals for insecticides, smoke and special purposes. All the aluminum alloys are quite resistant to atmospheric corrosion and attack by ethyl fluid. The heat-treated wrought alloys are not so resistant and are subject to an intercrystalline embrittlement in saline atmospheres. The aluminum coating (Alclad) furnishes excellent protection against this type of corrosion. Tidewater exposure for a period of four months causes a drop of approximately 50% in elongation for items 6A and 7A whereas, Items 5, 6B and 7B show no loss (Table II).

Magnesium alloys are quite susceptible to salt water corrosion and cannot be used in thin sections unless thoroughly covered by protective coatings which form a continuous film impervious to moisture.

Copper and nickel alloys need no protection except a thin film of oil or grease. Continuous exposure to salt water will cause the formation of chlorides and subsequent oxidation. They are not attacked by ethyl fluid in gasoline.

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Airplane Stresses

The Application of Integral Equations to the Calculation of the Static Strength of Airplanes (Zastosowanie równán catkowych w statyce lotniczej), A. Grzędielski and R. Seredyński. Sprawozdania, Instytut Badań Technicznych Lotnictwa (Polish Institute of Aeronautical Research), No. 1 (16), 1935, *pp.* 5-43, 17 figs., 10 tables.

AS A result of research undertaken at the Institute of Aeronautical Research at Warsaw, a simple method is established and elaborated for the use of airplane designers in calculating the static strength of airplanes. The work is based on integral equations developed by G. Wiarda. The authors take up the calculation of the deflection, bending and compression of wing spars and the angles of torsion of a wing, and determine the equations for the frequency of the free oscillations of the wing as well as the cooperation of wing spars.

Aerodynamics

A Study of the Flow in the Boundary Layer of Streamline Bodies, Hilda M. Lyon. (British) Aeronautical Research Committee—Reports and Memoranda No. 1622, *May* 15, 1934 *(published May* 18, 1935), 54 *pp.,* 26 *figs.*

MEASUREMENTS OF total head and surface pressure are discussed which were made within the boundary layer of each of two models in a bare tunnel and at a distance of 2 feet behind a wire mesh screen. The distribution of skin friction was calculated from experimental results as well as by a theoretical method which is capable of wider application when more experimental data is available. The wide difference between the drag coefficients for the two models in the bare tunnel has been shown to be due to the effect of the pressure distribution on the position of the transition from laminar to turbulent flow within the experimental range of Reynolds number and may be expected to disappear at higher Reynolds numbers.

Aerodynamics

Thirty Years of Theoretical and Experimental Research in Fluid Mechanics, D. P. Riabouchinsky. Royal Aeronautical Society Journal, Vol. 39, *Nos.* 292 *and* 293, *April and May,* 1935, *pp.* 282-348 *and* 377-441, 245 *figs. Bibliography.*

RESEARCH CARRIED on by the author in fluid mechanics is discussed and the results compared with those obtained in the investigation of others. The author describes the foundation and organization of the Aerodynamic Institute of Koutchino where he worked until he transferred on his research to France in 1918. The first instalment includes the period from 1904 to 1918 and covers such research as autorotation, the first approach to the slotted wing, resistance of rotating sectors and the autogiro, propellers, rotating plates and cylinders, flow patterns, and comparative research on wind tunnels.

Results obtained in experiments on skin friction and momentum are taken up in the second instalment as well as research on a pendulum oscillating in a stream, autorotation of projectiles, vortices astride obstacles, the propeller and airfoil vortex theory, contraction and reaction of gaseous jets, rockets, Helmholtz-Kirchhoff theory of resistance, change of regime in fluid motion and turbulence, new applications of the Hele-Shaw method, and cavities.

(Continued on page 111)

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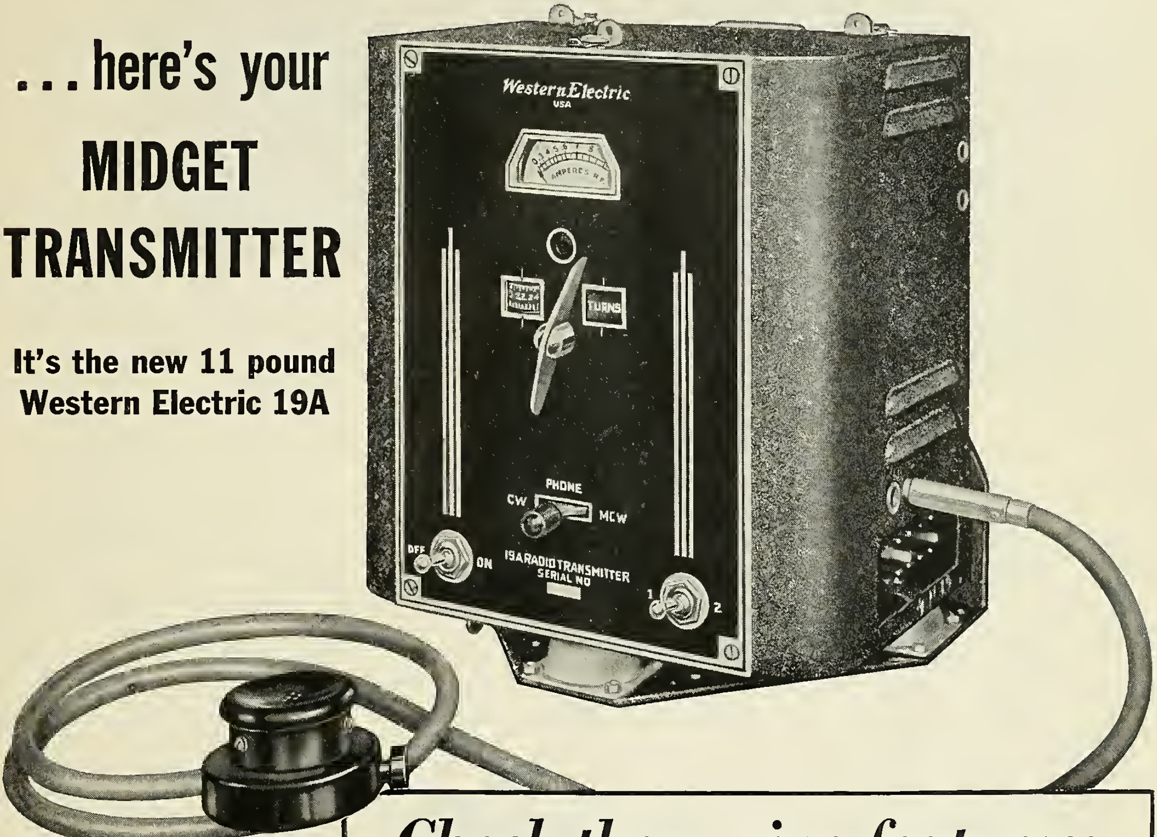

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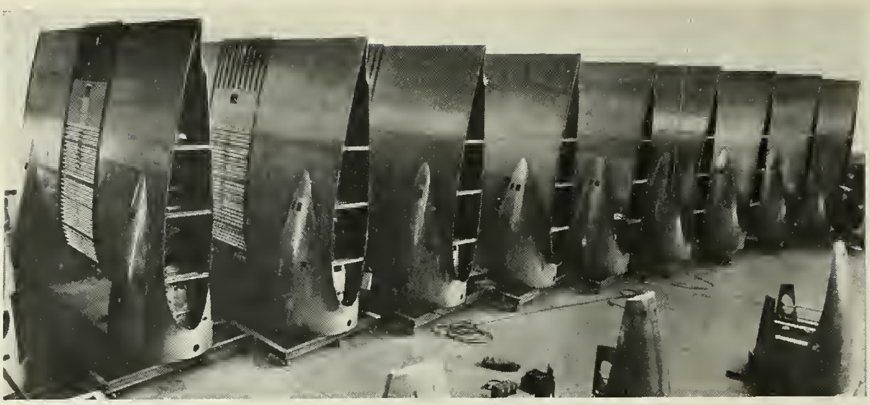


Line of aluminum alloy center sections

Douglas DC-2 transport

THE STORY OF ALUMINUM IN AIRCRAFT

F. C. PYNE

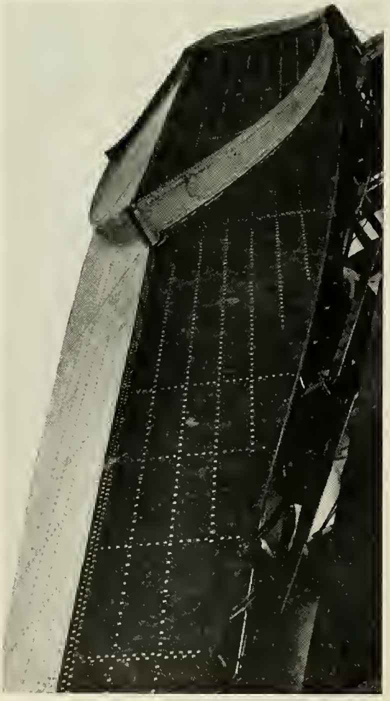
Aluminum Company of America

● In the early days of flying, wood was the principal material used in aircraft construction. This was largely due to the rapidity with which designs were changing and to the lack of reliable metals and a knowledge of their use in this type of construction. Wood readily lends itself to changes in design in small quantity production and does not normally require the expensive tools and equipment to fabricate as does metal. The first strong aluminum alloys did not appear until 1909, but at that time, experience upon which to base the design and construction of metal aircraft was almost totally lacking. Satisfactory high strength corrosion-resistant alloy steels represent a development which came at an even later date.

The discovery of the electrolytic process for making aluminum by Charles Martin Hall in 1886, reduced the price of the metal to a point where it could compete with the common commercial metals. For a number of years after that it was used either in the substantially pure state or hardened by simple alloying, combined, in the case of wrought products, with cold working. These early alloys did not possess mechanical and other properties entirely suited to aircraft construction. In 1909, Wilm developed a heat-treated aluminum-copper-manganese-magnesium alloy known as "duralumin," which has been and, in various modified forms, still is the most widely used aluminum alloy for the stress-bearing members of aircraft, and was largely responsible for the development of the Zeppelin type of airship.

The necessity for dependable light alloys and a knowledge of their use became more and more evident as the development of airplanes of the monocoque or semi-monocoque type progressed. Flying boats and amphibion aircraft, often operating under extreme conditions, also demanded high-strength light-weight alloys capable of withstanding the action of salt water without extensive maintenance.

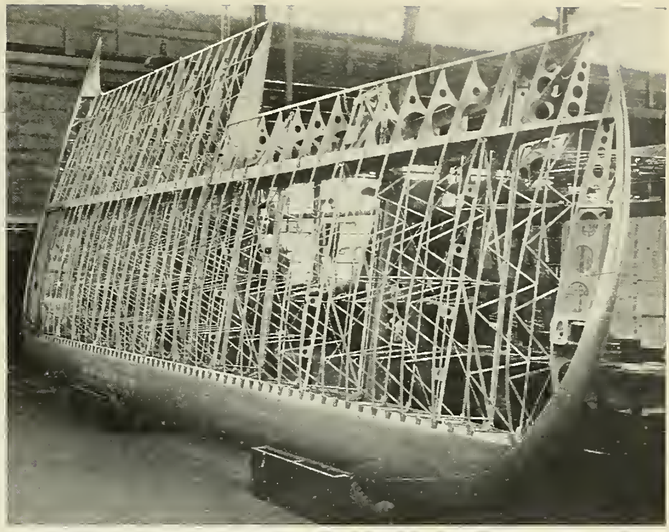
During the past few years, a great deal of work has been done not only in the development of more useful and dependable aluminum alloys but in their application to aircraft under all conditions. Aluminum producers have made a practical study of the requirements for aircraft, have visited operating bases and repair depots, both commercial and military, and have closely cooperated with the technical staffs of aircraft manufacturers and government agencies operating or supervising the manufacture, operation or repair of aircraft.



Consolidated flying boat hull

In 1927 Alclad sheet was first offered to the industry, and was almost immediately put to practical use. The Navy metalclad airship ZMC-2 represents one of the earliest applications of Alclad sheet. This ship was built by the Aircraft Development Corporation of Detroit and delivered to the Navy in the summer of 1928. The skin covering was of .0095" thick Alclad 17S-T. This thin covering was not given any protective coating, yet after four years of service, test specimens removed from the skin showed that the material did not suffer measurable loss in mechanical properties. The ship is still in active service and apparently perfectly sound in all respects. This illustration, coupled with the fact that Alclad materials have been exposed bare to salt spray for eight years without having their structural integrity impaired, is evidence of their ability to resist corrosion.

Because Alclad sheet has inherent corrosion resistance built into the material, many manufacturers have used it extensively without going to the expense of individually anodizing and shop-priming each part prior to assembly. Anodizing, an electrochemical process which produces a heavy coating of aluminum oxide on the surface of the metal, is not only a protective coating but an excellent means of preparing the surface of the metal to provide maximum paint adherence. If anodizing is not resorted to prior to priming, suitable chemical cleaners must be used to insure satisfactory paint adhering qualities. Some of the outstanding transport aircraft now operating are made largely from unpainted Alclad sheet and are giving a satisfactory account of themselves, especially from a maintenance standpoint.



Aluminum alloy wing of a Fairchild cargo plane with a total weight of 623 lbs., and designed to carry a load of 37,000 lbs.

Although duralumin (17S-T) has proven itself to be a satisfactory structural material for aircraft, there is a demand for materials having higher strength-weight ratios. To meet this demand, 17S-T was cold rolled after heat-treatment, producing 17S-RT. In order to provide a less expensive material having somewhat better working characteristics and higher ductility, 24S-T was developed. If 24S-T is cold worked after heat-treatment, 24S-RT is produced, and if some workability and ductility can be sacrificed, this alloy has the highest strength-weight ratio of any of the aluminum alloys ordinarily used for aircraft construction. The accompanying table shows typical mechanical properties of 17S and Alclad 17S, as well as those of 24S and Alclad 24S, in the various forms and tempers in which these alloys are available. In designating the condition of the various alloys, the symbol O indicates the annealed condition; T, heat-treated, quenched, and aged; RT, cold-worked in the T condition.

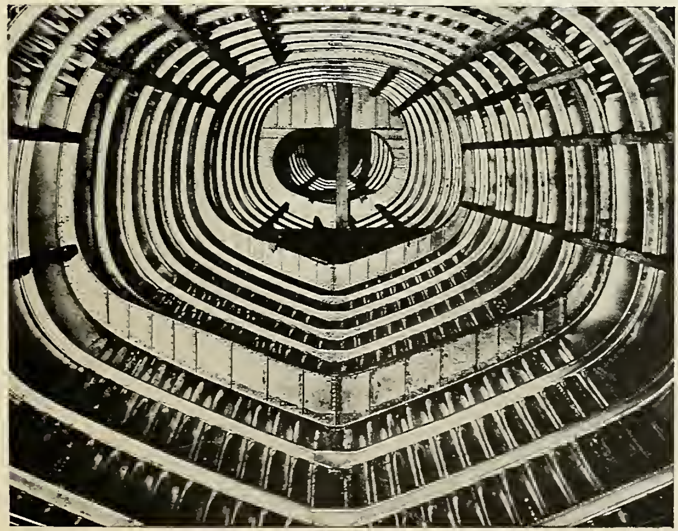
Mechanical Properties of Wrought Aluminum Alloys

Material	Tensile Strength (lbs./sq. in)	Yield Strength (lbs./sq. in)	Elongation (% in 2″)
	Sheet		
17S-T	58,000	35,000	20
17S-RT	61,000	46,000	13
Alclad 17S-T	55,000	32,000	18
24S-T	65,000	43,000	20
24S-RT	68,000	53,000	13
Alclad 24S-T	60,000	40,000	18
Alclad 24S-RT	62,000	49,000	11
	Tubing		
17S-T	65,000	45,000	22
24S-T	70,000	50,000	22
	Extruded Shapes		
17S-T	58,000	36,000	16
24S-T	65,000	46,000	16

Riveting has always been the most widely used method of joining the component parts of metal aircraft structures, and aircraft-riveting technique has been developed to a high degree. However, sensing the economies to be obtained through spot welding, much thought and effort was expended in the development of a satisfactory spot welding technique. Assuming reasonably uniform surface conditions and uniform electrode pressure, it was found that consistent and reliable spot welds could be obtained in most aluminum alloys by making use of a machine capable of delivering a large current output at the point of weld over a short and very closely controlled interval of time. Correct electrode design and low inertia of the moving parts of the welding machine were matters of importance and these features have been worked out and are incorporated in machines intended for use with aluminum alloys. When spot welded, Alclad materials afford the most reliable and consistent results in comparison with any of the heat-treated aluminum alloys. The aluminum alloys which are not heat-treated may be satisfactorily spot welded, the newer alloy 52S giving particularly satisfactory results.

In electric resistance seam welding which is merely a special application of spot welding, the electrodes consist of power-driven rollers. The synchronous power impulses are timed so that the spots are close enough together to form a continuous seam. The operation is fully automatic. In both spot and seam welding, the timing element is of the utmost importance and is, today, obtained by means of electronic timing equipment.

Interior view showing structural details of aluminum alloy flying boat constructed by Glenn L. Martin Company



Aluminum and its alloys have made noteworthy contributions to the power plant of the airplane and its propeller. Even before the introduction of heat-treated castings and forgings (which did not occur on any appreciable scale until

(*Continued on page* 117)

THE PARTS VENDOR'S CONTRIBUTION TO AIRCRAFT ENGINE DEVELOPMENT

●

GLENN D. ANGLE

● Let us go back fifteen or twenty years and consider the major problems associated with aircraft engine development during, and immediately following, the period of the World War. Aside from greater dependability, engineers were striving then to increase the power output for a given piston displacement and reduce specific weight, just as they are today. Much was being accomplished by means of better design, but it was evident that suitable materials having a higher strength-weight ratio were required in order to make substantial progress in this direction. It was also imperative to discover materials, as well as methods of fabricating them, to relieve certain structural and design weaknesses which were especially common at that time. Two very good examples of this sort were represented by the frequent failures of valves and bearings.

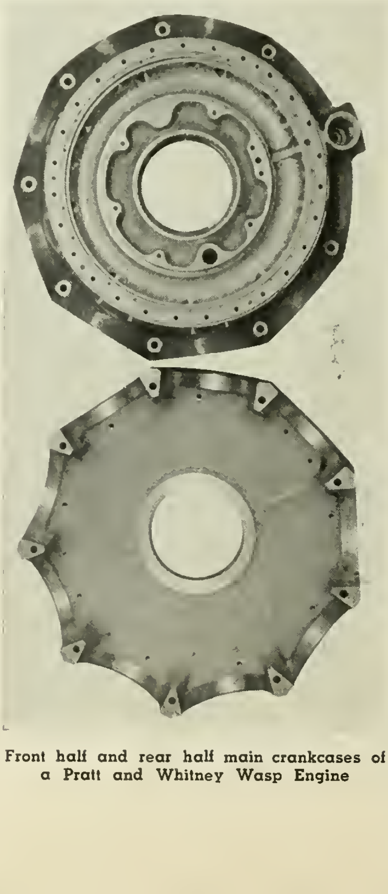
Now, it seems reasonable to assume that a brief discussion dealing with the efforts put forth in the solution of the particular problems just mentioned should convey the theme of our story. Naturally, the comments must be confined to a few significant facts associated with these developments, and not embrace matters of a strictly technical nature. In our examination of the improvements in the physical characteristics of materials, space can be given only to the lighter alloys. The refinements in the manufacture and treatment of alloy steel, as well as the white and yellow metals, are equally as important perhaps, but under the circumstances these can be neglected on the score that their applications are wide spread and the progress, therefore, has not been so closely identified with aircraft engine development.

Light Alloys

Although certain phases of the story dealing with the development of light alloys for aircraft engines have been presented on numerous occasions, they still should be sufficiently interesting to bear repeating if only space would permit. Under the circumstances, however, we must be content to review just a few of the outstanding facts, and thereby neglect any attempt to deal with these matters chronologically or with any degree of completeness.

At the time, to which we have previously referred, it was the usual practice to employ a cast aluminum alloy, known as No. 12, for such parts as crankcases and housings of various sorts, as well as many other smaller engine parts which could be formed easily by the casting process. This alloy was, and still is for that matter, an excellent material for general purposes, because it is relatively easy to cast and it has fairly good machining properties. However, difficulties were encountered sometimes with large castings, especially those which contained a number of cores, and the foundry losses were fairly high due to porosity and uneven shrinkage. Appreciating the importance of uniformity and soundness in castings used for aircraft, the metallurgist and foundryman set about to find means of overcoming these difficulties.

Having once developed methods for better controlling castings made from the No. 12 alloy, containing 8 per cent copper, or a slight modification of it known as No. 112, the next step was to develop alloys having more desirable physical properties. The tensile strength of alloy No. 12 ranges from 18,000 to 23,000 lb./sq. in. as cast. Without taking the trouble to individually refer to the various aluminum alloys that are at present available, the extent of the progress can be measured by the fact that, through alloying and the development of heat treating processes, there are now wrought alloys having a tensile strength well over 60,000 lb./sq. in.



Front half and rear half main crankcases of a Pratt and Whitney Wasp Engine

But to return to the improvements in cast aluminum alloys, it seems important to mention the 195 alloy, which has served the engine designer so effectively in securing light and dependable castings that are subjected to comparatively heavy load. The heat-treated 195 alloy has a tensile strength 50% higher than No. 12. Its elongation, which is a measure of its toughness, is four times as great; the yield point is 35 per cent higher; and the hardness of the two is practically the same. While the 3 per cent reduction in density is important, the most effective saving in the weight of castings made of this alloy has come through the use of thiner wall sections, which are often practical due to the elimination of artificial stresses in the material as cast. Thus the metallurgist has provided the engine manufacturer with a material for structural castings which has insured both greater reliability and a substantial reduction in weight.

There are several special purpose alloys whose uses have played a most important part in the performance and reliability of aircraft engines. These may be cast in sand or in permanent moulds, and there are others which are formed by the forging process. We cannot devote the space to refer specifically to each alloy and its physical and thermal properties, or to the special purposes for which it may be employed. Opinions differ somewhat in such matters, and the conditions may vary sufficiently among designs to warrant some experimentation before the material best suited for the purpose is selected.

At any rate, for those parts which operate under fairly severe conditions, such as pistons and cylinder heads—either air-cooled or those using a cooling medium of high boiling point, the engineer has at his disposal a number of aluminum alloys of different physical and thermal properties. Again we find that the metallurgist has recognized the problem of the engine designer, and developed alloys which have not only overcome his immediate difficulties, but permitted him to take advantage of the improved characteristics of these new materials and design lighter and more efficient engines.

A special piston alloy deserving special mention at this point is No. 32S, a composition containing about 13 per cent silicon in aluminum, with smaller portions of nickel, copper and magnesium. Its principal features are a lower coefficient of expansion and a lower specific gravity than any of the other aluminum alloys employed for pistons. It is possible to fit pistons of this material with 20 per cent less clearance, and the reduction of reciprocating weight is recognized generally as an important feature in any design. Moreover, this material has much superior wearing qualities, and its thermal conductivity is apparently as good as any other aluminum alloy suitable for pistons. Here is an example of a valuable contribution to the art of engine building, the metallurgist having greatly improved some of the less desirable characteristics of aluminum pistons without detracting from their principal features.

Aluminum-alloy forgings have come into quite common use during the past few years for parts requiring high strength-weight ratios. The processes of fabricating the materials in this manner were under development from 1921 to 1923. Simple connecting rods were the first commercial applications, although not in every case did these at first meet with entire success. It was found necessary, in designing connecting rods, to give due consideration to the peculiarities of the lighter material when formed by the forging process, as well as its greater expansion under heat. However, we may pass over the technical considerations of this development at this point to mention the fact that aluminum-alloy forgings have been used successfully for some time as link connecting rods. This has resulted not only in a substantial weight saving, but a marked reduction in manufacturing costs as well. It has been found possible to entirely eliminate pin bushings if the bearing surfaces of the pins are made sufficiently hard.

The four strong wrought aluminum alloys commonly used in the aircraft industry are known at 17S, 24S, 25S and 51S. The 17S and 24S are used chiefly in airplane and dirigible construction in the forms of sheet, tubing, and extruded shapes, while 25S and 51S find their main applications in aircraft engine forgings.

The properties of 25S makes it suitable for propeller blades, connecting rods and bearing caps; in fact, most all such engine parts subjected to repeated stresses, so long as the fibre stress does not greatly exceed 12,000 lb./sq. in., and generous fillets are provided. In its heat treated state, this material has an average tensile strength of 58,000 lb./sq. in., a yield point of 35,000 lb./sq. in., an elongation of about 18% in 2 in., and a Brinell hardness of 100 to 110. It forges readily in simple shapes and, as pointed out above, is a good bearing material if operated upon a hard surface which is provided with adequate lubrication.

Typical forged aluminum alloy piston

Alloy 51S has a somewhat lower ultimate strength than 25S, but it is not inferior in yield point and hardness. Its superiority lies in ease of working. Ever since the development started in 1926, there has been a constant use of crankcases, nose pieces, and other deep drawn forgings of this material for aircraft. There really is no need to call attention to the structural advantages and the increased engine reliability contributed by this development.

In 1930, the art of forging aluminum alloys was applied to the production of pistons. Today, we have several designs in regular service giving more satisfactory results than ever could be expected under the conditions with the moulded types. Again the metallurgist has contributed an important development in the steady progress of building more dependable and more efficient aircraft engines. The alloy used for the forged pistons is not the same as that ordinarily employed for other engine parts. Known as 32S, it contains from 11.5 to 13% silicon.

The foregoing references to some of the outstanding examples in the development of aluminum alloys, together with the methods of forming and their heat treatment, represent only part of the progress in the light alloy field. While not finding such wide uses up to the present time, the development of magnesium alloys has shown steady progress ever since the initial attempts to make practical applications some fifteen years ago.

Magnesium alloys have also contributed a great deal to the progress of aircraft engine design although as compared with the aluminum alloys they must be considered as only newcomers into the light metal field. The development of the magnesium alloys has shown steady progress ever since their initial introduction some fifteen years ago.

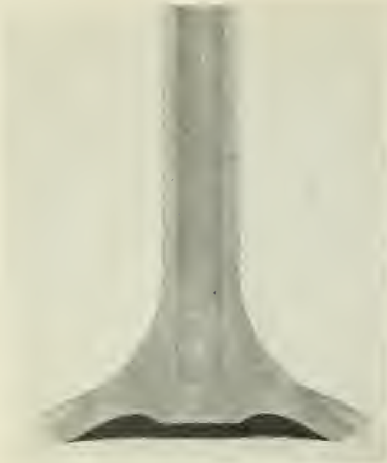
Many problems confronted the foundryman in his early efforts to make castings of magnesium. To prevent oxidation, it was at first necessary to pour the castings in a partial vacuum, or with an inert gas, usually nitrogen, surrounding the mold. Then too, there were many problems connected with molding operations and consequently only the most simple forms were undertaken at the start. This stage of the magnesium foundry industry is long past and any casting which can be made in an aluminum alloy can now be made in the lighter weight magnesium alloy.

The low specific gravity of magnesium, which is 60% of that of aluminum, plus the fact that its alloy strength is equivalent to the best cast aluminum alloys, has made its use most alluring to the aircraft engine designer. In his continued efforts to reduce engine weight, the designer has constantly encouraged the metallurgist in the tedious task of developing magnesium to a point of commercial usefulness.

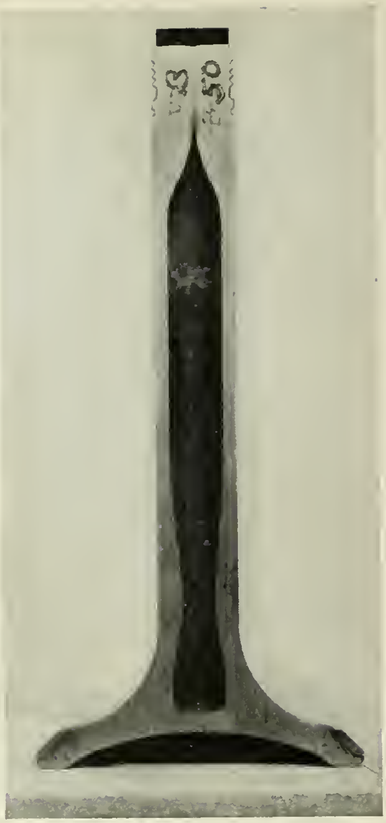
With the development of fluxes which had sufficient viscosity to protect the molten metal and which could be kept out of the final casting, together with the development of proper molding and coring sands, commercially cast magnesium alloys became a reality. Stability against even salt containing atmospheres has been solved to a satisfactory degree by a dichromating of the cast surface which consists of submerging the castings in a solution of sodium dichromate and nitric acid. This operation takes but a few minutes but it does materially increase the stability of the surface and at the same time provides an excellent surface for paint adhesion.

Some idea of the present use of magnesium for crankcases, accessory drive housings, pumps, manifolds and rocker box covers for aircraft engines may be realized by the fact that approximately 80% of the output of one of the largest magnesium foundries in this country goes to aircraft and aircraft engine manufacturers. Even at the present time, the difference in cost between magnesium and aluminum castings is well justified by the saving in weight accomplished.

Even if it is assumed that the per piece price of a magnesium crankcase, for instance, is higher than that of aluminum there are some factors which tend to offset this difference. A magnesium casting machines in an excellent manner and



Stellite seat and swedged head



Sodium-cooled exhaust valve

Excellent surface on valve seat

saves approximately 15 to 20% in cost as compared with aluminum. The saving in freight and handling is also in favor of magnesium. Whenever low engine weight is sufficiently important to bear the slightly higher cost of magnesium heat treated castings, they will be substituted for those in aluminum. As their use continues to increase, lower foundry costs will result so that the differential in cost over aluminum will continue to be a decreasing factor.

Valves

The severe nature of the conditions under which valves are required to operate in aircraft engines has caused them to be placed in a prominent position on the list of troublesome parts. While this is likewise true to some extent among internal combustion engines of all types, it is only in rare instances that we encounter such high brake mean effective pressures and such long periods of full-throttle operation that aircraft service ordinarily demands.

The task of grinding or replacing valves at frequent intervals during the early days of aviation was accepted, more or less, as a necessary evil. The best materials known for such purposes were employed in most cases, so it naturally followed that any immediate improvement in an extremely troublesome case must result through refinements in design. However, the field for improvement in this direction is restricted by well-known design considerations. and no designer can hope to attain a better performance and a higher degree of reliability than the valve materials which are at his disposal will insure. It was only natural that he turned to the metallurgist for assistance in his efforts to discover remedies for this particularly annoying problem.

Tungsten steel was commonly used for exhaust valves near the end of the World War, being about the only material then available with sufficient strength and hardness at high temperatures to withstand the shock loads and and wear. However, oxidation was far too rapid at full-throttle or near full-throttle operation with valves of this material; furthermore, frequent breakages indicated much higher degree of brittleness than this sort of service would stand with safety.

Earnest investigations were undertaken, both here and abroad, to discover, if possible, some material which possessed the properties necessary to meet these severe conditions. At this point it should be mentioned that the engineer and manufacturer of aircraft engines was fortunate to receive the full cooperation and assistance of the valve and alloy-steel makers. The latter readily accepted their share of the task in solving this problem, which mainly consisted in metallurgical investigations of alloy steels that might meet these requirements, and preparing and submitting samples for test.

It will be understood, of course, that we cannot devote the space that would be required to refer to all the valve materials investigated. Suffice to say, it is unlikely if any material of promise was overlooked. Naturally, in many instances, materials having some promising characteristics were found by test to be practically void of certain other essential requirements.

Out of this early research came, at least, one valve material worthy of special mention. We refer, of course, to Silchrome steel, which has been used so extensively in both aircraft and automobile engines. This material displayed acceptable non-oxidizing characteristics and, while not quite as hard as desired, it possessed other essential properties of such a degree that it worked rather well with properly designed valve guides of the right material at average engine outputs.

But, the engine designer was not to be satisfied with ordinary performances, so he turned to supercharging, increased compression ratios, and every other means at his disposal for raising the engine horsepower. As a result, the metallurgist and valve manufacturer have been confronted constantly with the problem of developing more suitable materials for aircraft engine exhaust valves.

Not being within the scope of our present discussion to deal with all of the technical aspects of these developments. the reader is expected to form his own conclusions—from the brief comments which follow with reference to some modern valve practices—as to the extent of the assistance which the designer has received. These remarks apply only to exhaust valves, since the intake valves do not present such a difficult problem. They are not exposed to such severe heat conditions and therefore need only have good physical properties.

To meet the conditions in modern aircraft engines of high output, a valve steel must have good oxidation and corrosion resistance, good hot hardness, high impact value, good wearing qualities. hardenability, machinability, good creep value and high strength under heat.

Because of its resistance to oxidation

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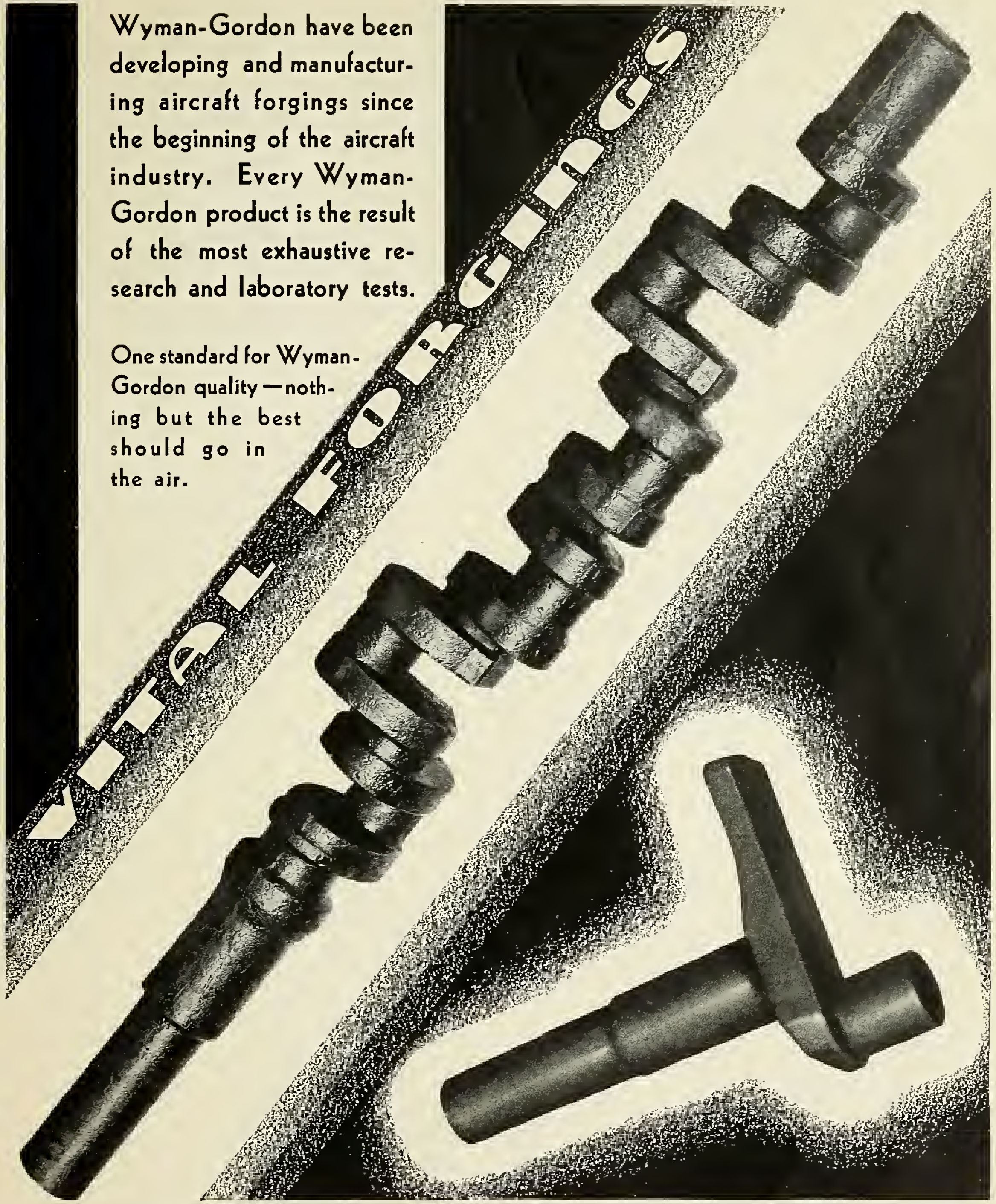

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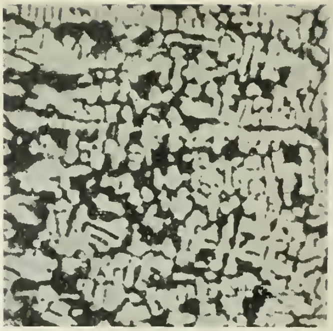
and corrosion, strength under heat, and good impact value, austenitic steel has become widely used. The specification approved by the U. S. Army and Navy is TPA. This steel contains approximately 15% chromium and 15% nickel, with smaller quantities of tungsten and silicon. At 1600° F., it has a tensile strength above 25,000 lbs./sq. in. Lacking hardenability and hot hardness, stellite is puddled on the seat in thicknesses varying from 1/32″ to 1/16″, which produces the necessary hardness and corrosion resistance at this point. To obtain good wearing qualities on the stem, the valves are sometimes nitrided to give them a thin skin of very hard material. Austenitic steel, however, has good wearing qualities when operated in a bronze guide, and particularly when adequately lubricated. Unfortunately, it does not have the proper hardness for the tip of a valve, so a high carbon steel tip is welded on and treated for tappet wear.

The exhaust from a cylinder developing 100 h.p. is now being passed through a single valve, an accomplishment which only a few years ago would have been considered impossible. This has introduced a problem in cooling, in addition to securing the above mentioned properties necessary to resist such severe conditions of heat. To assist the transfer of heat from the seat to the stem, where it may be dissipated through the valve guide, the stems are made hollow and filled with chemically pure metallic sodium. In some cases, these valves are made also with hollow heads of one-piece construction.

It does not demand a great stretch of the imagination to appreciate how intricate the production of such valves really is; yet, it may help to clarify the situation considerably to mention a few important facts in this connection. Forging temperatures are controlled within close limits, and the valves are normalized after each forging operation. The amount of sodium inserted in these hollow stems must be properly measured, and all operations where sodium is handled must be conducted with the greatest of care. All valves are tested electrically after the sodium is inserted to determine if it is in good condition and of the proper amount. Valves with hollow heads are X-rayed to check the cavity contour.

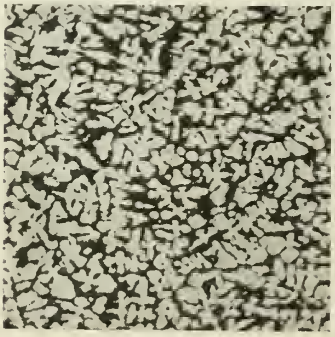
To avoid the possibility of a fatigue failure in the material under these severe operating conditions, a mirror polish is provided all over the outside, and the retainer necks are ground to remove all imperfections and tool marks. Furthermore, all valves are carefully etched several times in the course of manufacture to locate any defect, and the discovery of the slightest defect is sufficient reason for rejection. In some cases, valves are swedged under the head to increase the thickness at the point of extreme heat. All stellite seats are etched after grinding to disclose any possible flaws. Finally, inspection is carried out with 40-power binoculars to make sure that the valve is perfect in every respect.



Micrograph of high lead-bronze bearing

There are many design considerations associated with the use of the valves just described. For one thing, the stem clearance is important, because excessive clearance induces slap in the valve train and cuts down the amount of heat transfered to the guide. It is understood, of course, that the sodium cools by convexion, melting at 200° F. and splashing up and down as the valve reciprocates. It has no vapor pressure under 1600° F., and in this respect is a distinct improvement over the original salt-cooled valves. The type of valve mechanism also has important bearing on the successful operation of these valves. Special attention must be given to the factors inducing side thrusts on the valve stem, as well as to the flexibility of the valve train.

Where inserted aluminum-bronze rings were employed formerly for the valve seats in cylinder heads of aluminum, we now find steel seats of TPA material being used with even better results. Its high coefficient of expansion insures a tight fit after being shrunk into the aluminum, and the higher strength and greater resistance to corrosion make it much superior to aluminum bronze. At the higher engine outputs, the valve seats show a much better appearance than formerly and, so far, due to the lower temperature of the seat, it has not been found necessary to provide a stellite face.



Micrograph of bearing with 30% lead

From these sketchy comments regarding some of the developments with valve materials and their applications, it is evident that much research has been required by the valve manufacturer, in conjunction with the engine builder, to bring us to the present state of refinement. The designer has presented the metallurgist with some difficult assignments at all times; in fact, it might be said, in all fairness, that aircraft engine performances have improved only so far as the development of dependable exhaust valves would permit.

Bearings

The troubles encountered with crankshaft and connecting-rod bearings among the aircraft engines of an earlier period were often the result of bad design. It is a well-known fact, among those who have followed design progress, that stricter attention to the provision for lubrication, plus a more thorough engineering analysis of the load conditions, has contributed greatly toward added life and dependability. But, these are subjects which properly do not come in for consideration here, being mentioned only to show that the designer was not so wholly dependent then, perhaps, upon the metallurgist or bearing manufacturer for the solution of his problem, as he has been in several other instances to which we might refer.

Since the above design progress has occurred simultaneously with the use of better materials and the introduction of more accurate manufacturing processes, it becomes quite difficult to properly measure the share which the metallurgist and vendor of bearings has contributed toward this phase of aircraft engine development. But, needless to say, it has been considerable.

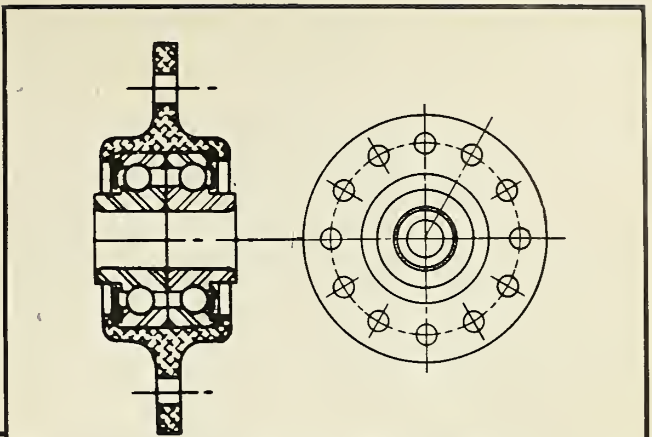
Experience showed that the linings in plain bearings must be more perfectly bonded and be capable of withstanding higher maximum and mean loads if the designer was to make substantial reductions in their length, and thereby shorten and lighten his engine. He insisted upon greater precision in manufacture so that the bearings could be assembled properly with less fitting. Results alone tell the story of cooperation far more completely than is possible through detailed references to one or more specific cases.

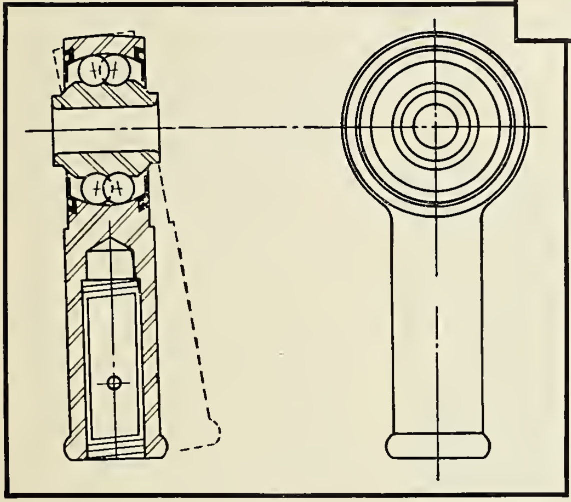
Several years ago it was discovered that many bearing failures, which might be traced ordinarily to lack of lubrication or overload, were really caused by deflections of the bearing shell, resulting either from lack of rigidity in the shell

(*Continued on page* 110)

TO ELIMINATE

Costly Play..





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AIRPLANE FABRICS AND DOPES

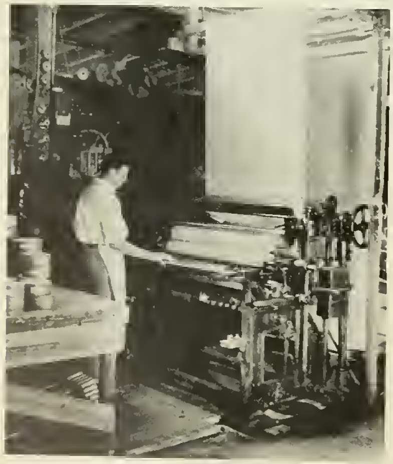
●

DR. GORDON M. KLINE

Bureau of Standards, Department of Commerce

● The majority of airplane manufacturers and consumers are still concerned with fabric coverings for airplanes despite the trend in recent years to metal construction for the larger types. A recent survey indicated that of 27 firms producing single-engined planes with seats for fewer than four persons, fabric coverings are used on the wings by 25 and on the fuselage by 23. Furthermore, Aeronautical Chamber of Commerce reports indicate that practically all of 647 non-transport type of airplanes licensed between January 1, 1934 and March 1, 1935, were constructed with fabric covering on the wings and fuselage. In the military services fabric coverings are of prime importance to-day, and will probably continue to be so for sometime because of the readier availability of materials and labor for the construction of this type of airplane. It is of interest, therefore, to consider the properties of the various fabrics and dopes that are used on aircraft.

In the early stages of the aviation industry fabrics were made from silk and later on from the bast fiber of the flax plant, better known as linen. These materials are quite expensive and their production is largely confined in the case of silk to Japan and of the finer grades of linen suitable for airplane fabric to Ireland, France, Holland and Belguim. The rapid development of aircraft during the war made it imperative to our national defense to find a satisfactory domestic airplane fabric. In cooperation with the National Advisory Committee for Aeronautics, the National Bureau of Standards began experimenting as early as January, 1916, to determine the feasibility of substituting cotton for linen airplane fabrics. Cotton airplane fabrics were developed which gave results in service equal to the conventional linen fabrics. So successful has this development been that the wing fabrics in general use in this country to-day are made from cotton.



Suncook Mills photo

Cutting fabric into rolls of tape

Properties of Linen and Cotton Fabrics

Higher tensile and tearing strengths can be obtained with linen than with cotton, but the performance of the latter in these respects has been found to be quite satisfactory for aircraft purposes (¹). It is also stated that linen is the most absorptive of all aircraft fibers and that the operation of doping can be carried out most effectively on such fabric (²). However, when the first coat of properly thinned dope is thoroughly brushed on cotton fabric, sufficient penetration of the cloth is obtained to secure the necessary coverage and adherence. To improve the strength and absorptivity of cotton for use in airplane fabrics, it is subjected to mercerization, that is, immersion under tension in a cold solution of caustic soda followed by thorough rinsing with water. This treatment also adds to the durability of the fabric and makes it much less stretchy, a valuable property in wing coverings where slackness is undesirable.

Some of the detail requirements for mercerized cotton cloth for use as a covering for the wings, control surfaces and fuselages of airplanes by the military services will be briefly summarized. The weave should be plain, i.e., the yarns passing alternately over and under one another. The cloth must be suitably calendered to lay any nap present and to provide a smooth, even surface. For Navy specifications, it should not contain over 1% sizing, should be chemically neutral, and have a weight/sq. yd. of 4 oz. Present Army specifications call for a sizing of not more than 3½%, and a weight limitation of 4.5 oz./sq. yd. Not less than 80, nor more than 84 threads per inch are used in both the warp and filling directions. All used are to be two-ply. The breaking strength tested by the strip method must not be less than 80 pounds per inch, both warp and filling. The percentage elongation under 70 pounds tension is not to exceed 12 in the warp and 10 in the filling. It has been found that two-ply mercerized yarns made from number 60s cotton yarn, i. e., yarn containing 60 hanks (840 yards) per pound, will give the desired physical properties.

Covering the Fabric

In order to protect the fabric against the deleterious influences of the weather, moisture, sunlight, fuels, and lubricants, it is treated with a solution known as a "dope". A satisfactory airplane dope should tauten the fabric to which it is applied, dry relatively rapidly without "blushing"—i.e., precipitating in white patches because of moisture condensation—give a smooth durable surface, and permit a low film weight. It has been found that certain esters of cellulose, particularly the nitrate and acetate, are the most desirable film-forming bases for dopes. These cellulose derivatives are insoluble in water, but form colloidal solutions in organic solvents. When the solvents evaporate, the colloidal film undergoes a shrinking action which makes the fabric drum tight. It is necessary to include both low boiling and high boiling solvents in formulating an airplane dope. Low boiling solvents are required to promote fairly rapid drying, which is necessary for economy of time in application, for satisfactory spraying operations, and to obtain the desired tautness. High boiling solvents are required to prevent blushing and to keep the cellulose derivative in colloidal solution until the non-solvents have evaporated. The non-solvents are relatively inexpensive organic liquids which are used to dilute the dope to the proper consistency for application. Such diluents make the cost of the dope considerably less than it would be if an all solvent blend were employed. Dopes also contain organic substances of very low vapor pressure which are intended to remain in the cellulosic film. These ma-

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(1) Walen, E.D., Natl. Adv. Comm. Aeron. Rept. No. 36 (1918).

(2) Haven, G.B., *Mechanical Fabrics*, John Wiley & Sons, Inc., New York City (1932).

terials are called plasticizers, and are added to keep the dope film from becoming brittle and cracking.

Cellulose Nitrate Dope

The airplane dope which is in generally used in this country to-day is made with a cellulose nitrate (sometimes termed nitrocellulose) base. The viscosity of this base material can be varied over a considerable range, but ordinarily a product of medium viscosity, approximately 8 to 10 seconds as determined by the ASTM method (3), is used. Ethyl acetate appears to be the most satisfactory low boiling solvent for nitrate dope and usually makes up about 20 percent of the dope by weight. A small percentage of acetone is sometimes added. Butyl acetate is ordinarily employed as the high boiling solvent, sometimes admixed with amyl acetate. The amount of high boiling solvent used varies greatly. For military dopes (which very often must be applied in atmospheres of fairly high relative humidity) the amount of such solvent may equal 15 to 30 percent by weight of the dope. In commercial dopes which are usually applied in dope shops under more favorable conditions, the percentage of high boiling solvents required is somewhat less. The diluents quite commonly found in airplane dopes are ethyl alcohol, butyl alcohol (normal and secondary), toluene, and petroleum distillate. The military services generally use from 40 to 55 percent of a mixture of toluene (predominating) and normal butyl alcohol. In this connection it should be noted that normal butyl alcohol (b.p. 117.7° C.) and toluene (b.p. 110.7° C.) form a constant boiling mixture under 760 mm. pressure at 105.5° C., composed of about 37 percent of the alcohol and 63 percent of toluene (4). A variety of organic materials are used as plasticizers, including dibutyl phthalate, glycol sebacate, castor oil, camphor, triphenyl phosphate and tricresyl phosphate. Approximately 1 part of plasticizer to 9 parts of cellulose derivative is required to obtain satisfactory ageing properties and also to prevent excessive tautness of the doped fabric, which would result in weakening or warping of the framework to which the fabric is attached.

Cellulose Acetate Dope

The only other airplane dope base used to any extent is cellulose acetate. This material was employed almost exclusively during the war, but its use in this country to-day is practically confined to the dopes applied to the outer covers of airships. However, it is understood that cellulose acetate dope is still used on airplanes in some countries, particularly France and Japan, rather than the less expensive cellulose nitrate, because of the fire hazard which is inherent in fabric doped with cellulose nitrate. The formulas of cellulose acetate dopes include low and high boiling solvents, diluents and plasticizers, just as in the case of cellulose nitrate dopes. The low boiling solvent is nearly always acetone, present to the extent of about 40 percent of the dope. The high boiling solvent is generally diacetone alcohol, benzyl alcohol or ethyl lactate. Solvents of medium boiling range, such as 1, 4-dioxane and ethylene glycol monomethyl ether are sometimes added. The diluents for cellulose acetate dopes are ethyl alcohol and toluene. Benzene was also formerly used for this purpose, but is now prohibited because of its toxicity. The plasticizers commonly added to cellulose acetate dope include triphenyl phosphate, tricresyl phosphate, triacetin, diethyl phthalate and oibutyl tartate.

Surface Coatings

In order to prevent rapid deterioration of the fabric and dope film by the action of the ultra-violet rays of sunlight, pigmented dope is applied over all surfaces. The two pigments generally used on military planes are aluminum powder for the aluminum finish and lead chromate for the orange-yellow color. Approximately 4 percent pigment is present in pigmented dopes; the plasticizer content is usually greater than in clear dopes in order to keep the film from becoming brittle because of the added inert solid matter. The usual doping scheme is four coats of clear dope followed by two coats of pigmented dope. Two or three of the coats of clear dope are brushed on; the other coats are customarily applied by spraying. The four coats of clear dope should deposit a film weighing approximately 2.75 ounces

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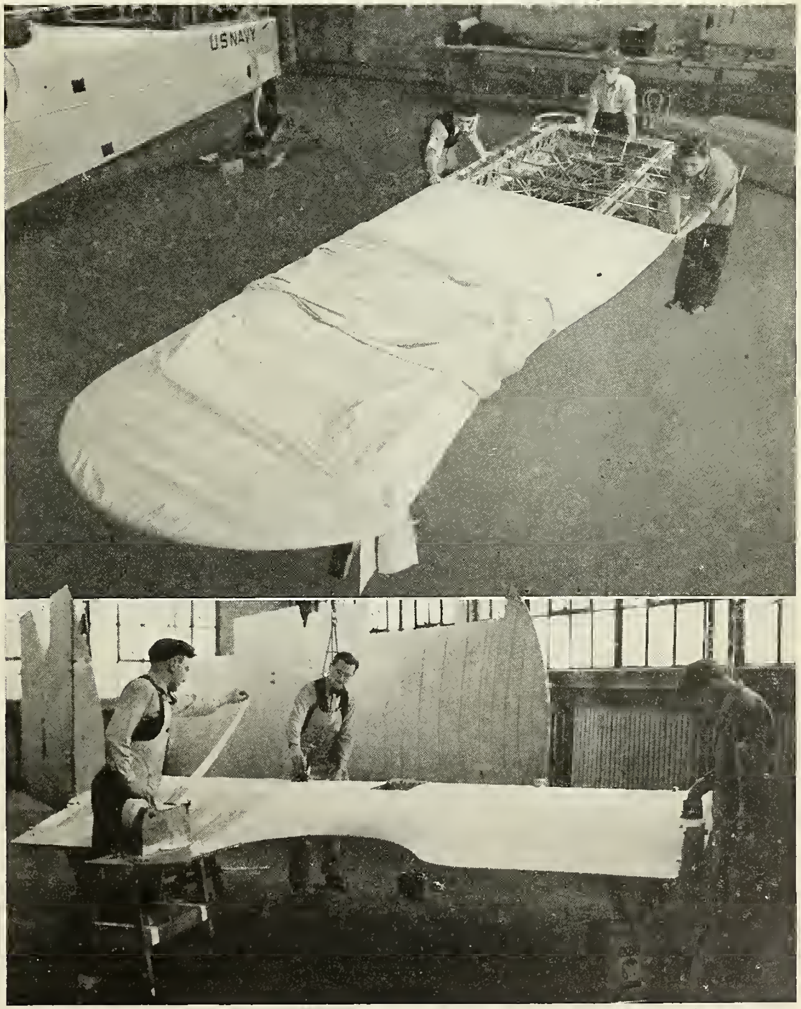

Sherwin-Williams Photo

Covering a wing panel and applying dope to a wing center section

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(3) Anonymous, Proc. Am. Soc. Testing Materials *31*, 793 (1931).

(4) *International Critical Tables*, first edition, McGraw-Hill Book Co., New York, *3*, 321 (1926).

STAINLESS STEEL CONSTRUCTION

●

W. L. SUTTON,

Chief Engineer, Fleetwings, Incorporated

● Possibilities of structural usage of 18-8 stainless steel are slowly arousing interest in the aviation industry, but its successful application can be obtained only by close adherence to a new design technique. In general, all fittings and attachments are designed with flanges as though they were to be riveted. However, the actual size of the flange is materially less than that commonly used for a rivet assembly since small diameter welds may be used to develop the full strength of the sheet. Tests have shown that welds placed very close to the edge of a flange develop as much strength as though they were placed back from the edge a distance of approximately two weld diameters. This feature allows the designer to use very small flanges, and by so doing, materially improve the efficiency of the resulting structure.

The actual application of stainless steel to aircraft differs as much from aluminum alloy construction as the latter differs from the old wooden structure. Since stainless steel is approximately half the thickness of the aluminum alloy sheet, for equivalent strength, it is necessary to support it at more frequent intervals, or else break up the flatness of the sheet by crowning, corrugating or working beads into the sheet.

Many designs require a smooth external sheet and weight limitations dictate that a thin gauge stainless steel be used. The most frequently occurring design is one in which the number of stiffeners is approximately twice the number used in a similar aluminum alloy design. Although at first glance, the cost of the additional stiffeners would seem to be prohibitive, the automatic process of spot welding these stringers to flat skin has lowered the overall cost to a point where the stainless steel structure can be built as cheaply as one of aluminum alloy. To do this, of course, requires that the work be laid out so that the majority of the welding can be accomplished through the use of roller electrodes, which can weld at the rate of 960 shot welds per minute. Final assembly work is usually accomplished by portable welding tools which closely resemble a squeeze type riveting machine. The work is usually held in place by small tack welds and after everything has been aligned, the final shot welds are completed.

In some cases (for instance when welding on the final sheets of hull assembly) it requires two men to complete the weld. One man is stationed inside the hull with a large copper electrode at approximately the point where the weld is to be made. The other remains outside the hull and uses a poke welder to procure a weld at the proper point. Since a good shot weld is dependent on obtaining the proper amount of pressure, this poke welder consists of a one electrode tool than functions only when a predetermined pressure has been applied to it. This method of assembly is more advantageous than orthodox riveting practice in that there are no holes to be drilled or provisions made for watertightness.

Another type of weld assembly used in thin skin stainless steel construction consists of making a mold to which long copper straps are fastened at the locus of the line or junction between the narrow stainless steel strips. These strips are then applied to the mold and fastened together by poke welding. The unit, consisting of several narrow strips which have been poke welded together in the correct shape, is then removed and the balance of the welding is completed by an automatic seam welding machine. This enables a number of long narrow strips to be fitted to compound curvature and yet accomplish the majority of welding by means of an automatic set-up.

Corrugated and flat sheet construction in the Luscombe Phantom flap

Recently a seaplane float was fabricated entirely of 18-8 stainless steel. All joints except at the water-tight bulkhead were made by seam welding. Longitudinal and transverse stringers were of modified omega section and were shot welded in the proper location to the bottom, side and deck skins before these parts were placed in the assembly jig. The bottom skin was then set up in the jig and the side skin seam welded to it by means of an external angle at the chine. The transverse stiffeners were then joined by welding them together at each flattened end. The flattening of the transverse members made it possible to join them without the use of gussets and materially decreased the number of parts required in the float assembly. The hand hole frames were seam welded to the top deck skin and the water-tight bulkheads were partially seam welded and partially soldered into place.

The stainless steel float had a displacement of 26.8 cubic feet per pound of weight. An existing design of aluminum alloy float for the same model airplane had a displacement of only 20.8 cubic feet per pound of weight. The stainless steel float was, therefore, ap-

(Continued on following page)

Examples of stainless steel construction: at the left a shot welded wing. Right: tail surfaces for Amphibians P3-B

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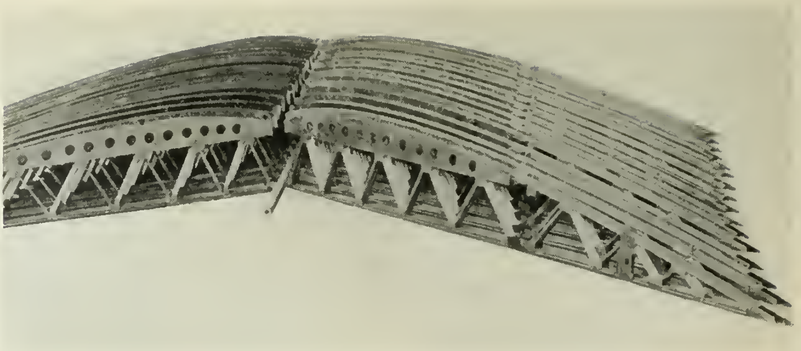
(*Continued from preceding page*)

proximately 30% lighter than the existing aluminum alloy float and can be produced at about the same cost. The stainless steel float has additional advantages in that maintenance is at a minimum since no corrosion problems are to be anticipated. Maintenance costs are further reduced by the ease with which repairs may be made to the float since it is possible to soft solder stainless steel plate over any holes that result from minor mishaps. It is, therefore, possible to produce a stainless steel float for approximately the same cost as an aluminum alloy float that will weigh less, be easier to repair, and have lower maintenance.

Fuel tanks have been made of seam- and shot-welded stainless steel that have had a lower weight than similar tanks of aluminum and aluminum alloy. The specific weight of these tanks varied from .50 pounds per gallon for wing tanks to approximately .70 pounds per gallon for rectangular, odd-shape fuselage tanks. In all cases the joint was made liquid-tight by running a continuous seam weld around the edges of the tank. In most instances, the baffles were also seam welded to the outer skin although some tanks have been successful that had the baffles merely shot welded to the outer skin. Since the instability of the thin stainless steel sheet tends to produce vibratory failures of the sheet itself, it has been found necessary in this type of construction to strengthen the flat panels by crowning, corrugating, or welding on closed stiffeners. The cost of making stainless steel tanks is unquestionably higher for one tank, but if quantity production can be obtained, the ease with which assembly can be made more than atones for the higher first cost required for stampings or fixtures.



Compression ribs fabricated entirely of stainless steel

Stainless steel has been successfully used in the design of wing spars which usually carry concentrated loads at a high unit stress. Block compression tests on short sections of stainless steel spars have yielded the high unit stresses of 187,000 pounds per square inch. The shear in these spars is carried either by a Wagner type web or else the thin skin is made resistant to buckling by the use of corrugations. A typical spar was placed on a tank vibration machine in order to determine whether the rapid reversal of stresses would cause weld failure. This spar was loaded to the yield point and additional peak stresses were applied to it through the use of the tank vibration machine. A few shot welds pulled off one side of the web but as there was no progressive failure, it was decided that the spar was satisfactorily resistant to fatigue.

Wing ribs have been built of stainless steel of approximately the same weight as aluminum alloy or wooden ribs. The cost of manufacturing a stainless steel rib is again entirely dependent upon the number required. Since no heat treatment, anodizing, or painting is necessary, the cost is somewhat lower than that of a comparable aluminum alloy rib. In the case of wing ribs, care is exercised to be certain that the rib is strong enough to stand local handling and damage since the thickness of the stainless steel required is usually around .006″ for the web members of the rib. In fact, stainless steel ribs with approximately an 11-foot chord and a depth of about 22 inches have been built using .006″ and .008″ thick stainless steel web members throughout. As in most stainless steel designs, the members usually are of closed sections to prevent local failure by twisting under compressive loads or by handling.

Tanks of stainless steel

Tail surfaces have also been fabricated entirely from stainless steel using large diameter thin wall tubes for spar or torque tubes. Ribs were shot welded to flanges which in turn were welded to the tubes by the use of an internal expanding copper mandrel. The trailing edge consisted of a closed stainless steel section which fastened directly to the end of each tail rib. The control horns were built-up box sections which under tests have proven to be very efficient.

Built-up stainless steel streamline struts have been developed that have shown approximately 15 per cent increase efficiency when compared to the standard streamline seamless tubing. These struts were made with a fineness ratio of 3:1 rather than a conventional 2-1/2:1 fineness ratio thereby increasing the aerodynamic as well as structural efficiency of the strut. Here again, no finish is required and no inspection or maintenance problems occur.

Through development of new methods of assembly, simplification of existing welding tools, and accumulation of general design data, the adaption of stainless steel to aircraft is rapidly reaching the stage where it offers distinct advantages from a structural and maintenance standpoint.

METAL AIRPLANE CONSTRUCTION

DR. ALEXANDER KLEMIN

Daniel Guggenheim School of Aeronautics, New York University

● In a symposium on the materials of airplane construction, it is appropriate that the evolution of metal construction should be reviewed—although the subject is so vast that a book rather than an article would be more appropriate.

Table 1: Stresses in lbs./sq.in.

	Spruce	Aluminum Alloy 17ST	Aluminum Alloy 24ST	Chrome Molybdenum Steels	Heat Treated Chrome Moly. Steels	Stainless 18-8 Steel
Specific Gravity	.43	2.8	2.8	7.85	7.85	7.85
Modulus of Elasticity	1.3×10^6	10.4×10^6	10.4×10^6	29×10^6	29×10^6	30×10^6
Yield Point in Compression....	5,000	30,000	40,000	60,000	150,000	150,000
Ultimate Tensile Strength	10,000	55,000	62,000	95,000	180,000	185,000
Shearing Strength	750	30,000	35,000	60,000	115,000	
Bearing Strength		75,000	90,000	140,000	200,000	
Fatigue Limit		13,000	14,000	40,000	85,000	75,000
Compressive Strength Open Sections		40,000				120,000
Compressive Strength Closed Sections						140,000

Advantages of Metal Construction

The final adoption of metal construction is justified by a number of advantages which may be summarized as follows:

(1) With metal it is possible to build large aircraft in a relatively simple fashion. It is true that a huge machine such as the Barling six-engined bomber, was built in wood, but its construction proved to be expensive and inordinately "fussy."

(2) For small machines, below the 100-horsepower class, wood construction is probably lighter than metal, because the theoretical gauges of metal are then too thin for practical use. But, for medium size and large machines, metal undoubtedly gives the lighter structure.

(3) Metal, being more homogeneous than wood, is also more reliable, and can be used with a lower factor of safety.

(4) Metal is less affected by climate and weather.

(5) Metal permits the construction of simpler, and mechanically more efficient joints.

(6) Fire hazards are reduced.

(7) Metal can be worked in a greater variety of sizes and shapes, and given almost any form, by pressing, rolling, drawing, extruding, forging, etc.

(8) Wood, and the glue which is almost an unavoidable concomitant of it, are organic materials, subject to bacterial and other types of decay. Metal is inorganic, and if suitably protected against corrosion is almost certain to give longer life.

Table II: Specific strength ratios

Material	Spruce	Aluminum Alloy 17ST	Aluminum Alloy 24ST	Chrome Molybdenum Steels	Heat Treated Chrome Molybdenum Steels	Stainless 18-8 Steel
$\frac{\text{Modulus of Elasticity}}{\text{(Specific Gravity)}}$	3.25×10^6	3.71×10^6	3.71×10^6	3.70×10^6	3.70×10^6	3.82×10^6
$\frac{\text{Yield Point in Compression}}{\text{(Specific Gravity)}}$	(11650)	10,700	14,280	7,650	19,100	19,100
$\frac{\text{Ultimate Tensile Strength}}{\text{(Specific Gravity)}}$	23,300	19,600	22,100	12,100	22,900	23,550
$\frac{\text{Shearing Strength}}{\text{(Specific Gravity)}}$	(1745)	10,700	12,490	7,650	14,650	
$\frac{\text{Bearing Strength}}{\text{(Specific Gravity)}}$		26,750	32,100	17,850	25,500	
$\frac{\text{Fatigue Limit}}{\text{(Specific Gravity)}}$		4,640	5,000	5,100	10,850	9,550

Modulus of Rupture for Spruce: 9400 lbs./sq. in.

Table III: Indicies of materials when used as beams (Spruce used as base)

Material	Relative Weights of Given Strength	Relative Depths	Relative Deflection
Spruce	1	1	1
Aluminum Alloy 17ST	2.18	0.56	1.27
Aluminum Alloy 24ST	1.96	0.55	1.36
Chrome Molybdenum	4.05	0.466	0.98
Heat Treated Alloy Steels	2.74	0.378	2.27
Stainless Steel (18-8)	2.72	0.376	...

(9) Where few machines of a series are built, wood is the cheaper medium. But, if airplanes are built even on a moderate mass production basis, metal becomes cheaper because of the many methods available for cheapening of construction, and the greater ease of assembly with definite metal elements.

J. A. Roché, in a 1927 paper before the S.A.E. made a valuable study of the comparative strength of typical materials. It is interesting to modernize his comparisons, taking into account the stronger aluminum alloys and steels now available.

In Table 1 we have given representative values for typical materials, spruce, 17ST, 24ST, chrome-molybdenum steel, heat-treated alloy steel, and the stainless 18-8 steel. On the basis of the representative values of Table 1, some specific strength ratios have been calculated in Table 2.

By simple theoretical methods, Mr. Roché has shown that for geometrically similar beams of different materials, having the same resistance to bending, and with the modulus of rupture assumed equal to the ultimate tensile strength:

(1) Weight $\alpha\ S/(fr)^{2/3}$

where: S = specific gravity

fr = modulus of rupture

(2) Depth for a given strength, $D\ \alpha \left\{\frac{1}{fr}\right\}^{1/3}$

where: fr = modulus of rupture, taken as equal to the tensile strength.

(3) Deflection for a given strength,

$$y \; \alpha \; 1/ED$$

where: E = modulus of elasticity.

With these formulae, Mr. Roché's calculations have been extended in Table I to take in the modern 24ST, and the stainless 18-8 steel. In this table all stresses are in lbs./sq. in., and, the heat treated chrome molybdenum alloy steels with ultimate values given may be used only for axles, struts, control parts, etc., whose wall thicknesses are not less than 0.120 inches, and whose attachment to other parts of the structure are either by bolts or rivets.

From these tables, and from certain other considerations, semi-empirical and semi-mathematical, (which space will not allow us to present) the following approximate considerations may be drawn:

(1) Some ten years or so ago, in arguing the respective merits of wood and metal, it was customary to point out that in tension, wood was stronger than other materials. Table II indicates that this is no longer the case. The specific strength in tension of wood is equalled by the heat treated steel alloys and surpassed by 18-8. It is, moreover, difficult to use for pure tension members.

(2) For short columns or tubes, where the effect of the yield point in compression is predominant, wood is the weakest material for a given weight; dural is stronger than the relatively mild heat treated chrome-molybdenum, and the heat treated alloy steel and the stainless materials are the strongest of all. This is indicated by the second line of Table II.

(3) For long columns, exposed to the air flow, and where the modulus of elasticity and the density alone need be taken into account, it is clear that wood and steel have approximately the same equivalent weight, or equivalent air resistance,—because in the wooden strut a lower slenderness ratio may be secured. It is also well known that an external dural strut will be too bulky for aerodynamic efficiency.

(4) For long columns, not exposed to the air flow, and where bulk is relatively unimportant (as in the fuselage) it is evident that hollow aluminum tubing will be superior to wood and also superior to steel of any type (the modulus of elasticity of steel being independent of its strength properties). Mr. Roché states that long aluminum columns can be made having four-sevenths of the weight of equivalent steel columns.

(5) The results of Table III need interpretation. If beams of various materials could be built in geometrically similar form, and if there were no restrictions on depth, then wood would be much lighter than aluminum alloy which is lighter than steel. Where great strength is required in a very thin wing section then the strongest possible steel would be desirable.

(6) Theoretically, if the depths of the beam in the three materials were the same, and width of wooden spars could be increased to any extent desired and if the modulus of rupture were equal to the tensile strength, then from Table II it would appear that wood, 24ST and high strength steel would be on a par.

(7) If practical spars are considered in pure bending then the following arguments apply. Less of the wood can be placed at the greatest distance from the neutral axis than with metal spars, and owing to low shear values, the thickness of the web is appreciable; it is impossible to use lightening holes, and difficult to build a truss. Metal spars can have their material disposed well away from the neutral axis, be trussed and have thin webs, but they lose strength by local failures in compression due to free edges, etc. If steel and aluminum spars are compared on the basis of section compression values, and specific gravities given in Table I, then in pure bending the absence of rivets in shot welded stainless steel would give this material superiority. With combined bending and compression the wooden spar would make a better showing owing to lower slenderness ratio, and for the same reason aluminum would also show up a trifle better. Comparative experiments at Wright Field indicated that the best metal spars are on a par with the best wood spars. But, the design of wood spars remains static, metal spars improve. Particularly in large sizes, and for cantilever monoplane work, metal will eventually show overwhelming superiority. There will always be little to choose between dural and steel.

(8) When we come to stressed skin, veneer covering proved suprisingly effective, taking up drag, resisting torsion, and with multi-spar construction being quite effective in taking a share of bending loads. It is difficult to see how steel skin can be as effective in taking up compressive stress as dural skin, owing to its low stiffness in thin sheet.

(9) Fastenings should be heaviest for wood, lightest for stainless steel.

Reviewing all these arguments, one may conjecture that aluminum should be decidedly lighter than wood, and have a slight edge on stainless steel. This is not meant to indicate, by any means, that stainless steel is inferior to aluminum in its ultimate possibilities.

Weight Saving by Metal Construction

It is remarkable how few definite comparisons under "scientific" conditions have been made. By scientific conditions we mean comparisons drawn from the metallization of an aircraft with no other changes than in the substitution of metal for wood.

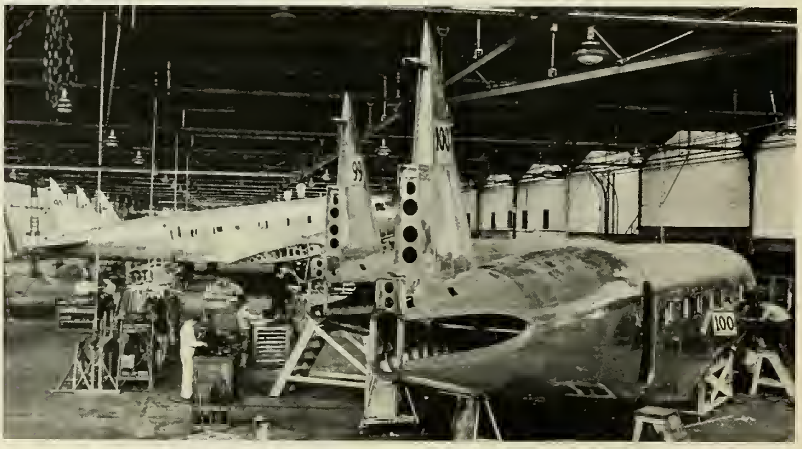
A study presented by Commander R. D. Weyerbacher in a paper before the S.A.E., October 1927, dealt with the PN-10 Navy Patrol twin-engined flying boat.

In converting the stick and wire PN-7 to dural, the weight of the wooden hull was reduced from 2340 to 1810 pounds, and the wings from 1931 in wood to 1465 pounds in metal. Savings in percentage were: ribs, 23.5%; beams, 12.6%; ailerons, 48.6%; hull 35%.

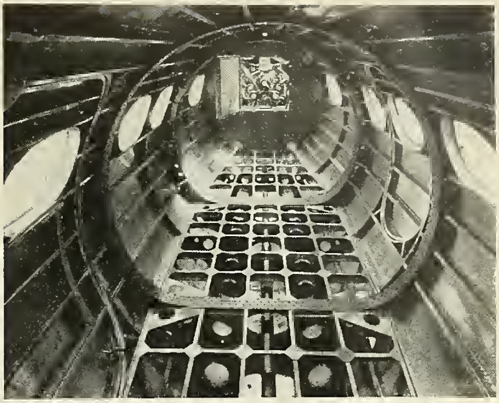
Another authoritative comparison of wood and metal construction was made by C. J. McCarthy, of the Chance Vought Corp. For a military biplane of 4500-4600 pounds gross weight, we find the following results:

	Metal	Wood
Upper front spar (lbs.)	17.1	23.1
Upper rear spar	16.5	23.9
Lower front spar	17.2	21.6
Lower rear spar	23.8	28.5

Budd Manufacturing Co., lightened up a Savoia-Marchetti considerably when,


The 100th all metal Douglas airliner as it neared completion

Metal framework for tail surfaces of the Fairchild "Super-71" and interior of fuselage showing structure



in 1931, stainless steel was substituted in structure and covering for the wood, wire and fabric previously employed. A structural saving of 6% to 8% was obtained.

In converting the TS Navy twin float seaplane to metal construction of the F4C-1 (about 1923), Charles Ward Hall reduced the total frame weight from 358.25 lbs. to 164.5 lbs. a saving of almost 54 percent. Practically the same percentage saving was secured in all structural groups.

Perhaps other similar instances of reduction in weight by metallization may be available, but in *no* instance was there a reduction in weight by resort to wood construction. Actual practice bears out the theoretical conclusion that metal structures are lighter than wood structures. In fact, in practice, the advantages gained are greater than those indicated by theory, because with wood it is impossible to use the correct section, because joints and fastenings are more difficult, because wood is less homogeneous and does not lend itself to the same refinement of calculation or construction, and because metallurgy advances, and wood properties remain the same.

Metal Planes Prior to and During the War

Prior to the war, American airplanes were built of wood, except the Army and Navy machines, designed by Grover Loening of the Sturtevant Aeroplane Co. As early as 1916, Mr. Loening built the S-4 seaplane in which the fuselage was entirely of steel and triangular in form, with channel members punched out and crimped at the edges. The entire empennage was also of steel.

War construction was exclusively of the stick and wire type, in the Curtiss Jennys, the Standard, DH4's, Martin Bombers and other historical machines. Still, even during the war, a real effort in metallization was undertaken under the joint auspices of the Army Air Service, the Bureau of Standards, and the Empire Aircraft Corp. To obtain a practical war solution in the shortest possible time, these cooperating agencies undertook to substitute metal for wood in the ribs, beams, struts and longerons of the Curtiss JN-4-D; and beginning late in 1917 this work was carried on energetically, till the end of the war. Two materials were used in the substitution: an aluminum alloy of an ultimate strength of 49,000 lbs./sq. in. and a chrome-vanadium alloy of about 77,000 lbs./sq. in. ultimate. Simple channels and riveting for the aluminum alloy and simple sections and electric spot welding with subsequent heat treatment as an assembled unit such as a spar were the methods employed. With substantially the same load factors (a little under 6) for both the metal and wood machines Curtiss JN4-D, the metal construction turned out to be only 5 pounds heavier for a machine having a gross weight of 2167 pounds. Considering the low strength of the steel employed, and the novelty of spot welding applied to primary structural members, the results were remarkably good and very promising.

Why We Lagged Behind After the War

Our constructors were not ignorant of the possible benefits of metal. The 1921 Aircraft Year Book states: "The best solution of the deterioration problem is the radical one of abandoning a wood structure entirely in favor of metal. Steel and duralumin are being used abroad, and while it is too early to judge with certainty, experimental planes built of other material seem to have proved successful." And further on: "It is evident that the future of the airplane could be profoundly influenced by a practical metal construction. Six avenues of attack present themselves:—(1), heat treated alloy steel tubing using fittings; (2), welded mild steel tubing; (3), rolled and stamped sections made from heat alloy steel strip riveted together; (4), duralumin tubing with fittings; (5), rolled and stamped sections made from duralumin strip riveted together; and (6), a riveted construction of duralumin plates and shapes."

Our constructors not only understood the possibilities of metal construction but were also well acquainted with the actual work of Dornier, Junkers and Rohrbach in Germany; Breguet and Wibault in France; and of their English contemporaries. They delayed the task of metallization first, because there was an almost superstitious dread of fatigue and "cracking" in dural or steel, and also, because the commercial production of strong light alloy sheet, rivets, sections, etc., was slow in getting under way. The construction of Zeppelins had given the Germans an understanding of light alloy employment for aircraft, and suitable materials. The French naturally followed this work. The English regarded dural with suspicion as not being a primary material, but had the advantage of an incomparable steel industry, with a large number of small units already interested in the production of strong strip steel. These units were only too happy to give the small aircraft industry a hand. When the writer in the later stages of the war sought to interest the steel industry in meeting aircraft needs, he was met by enquiries as to the hundreds of tons that might be required. The possibility of an order of two or three thousand pounds did not interest them.

Fokker and the Metal Fuselage

For several years after the war, the only step towards metallization which our constructors dared to take was in the metal tube fuselage, generally of welded tubing, but sometimes of dural. It is generally conceded that Fokker originated the use of the welded tube fuselage, and we owe Fokker a debt of gratitude that he brought his ships over to the United States somewhere in 1922-23 and that American constructors imitated him. If we remember rightly, the main argument used at that time in favor of the tubular fuselage was that in case of a crash the passengers and crews are not subjected to the effects of broken and splintered wooden members, whereas, steel members usually bend and buckle.

(*Continued on page* 112)

FITTING DESIGN AND MATERIALS

J. L. HARKNESS

Sikorsky Aviation Corporation

● This article is intended to give a few points on different classes and kinds of fittings together with their most common materials and design requirements. The word "fitting" is used in the sense of joining two or more parts and is understood to have functions of varying importance depending on location, such as primary structure, secondary structure, flying controls, engine controls, etc.

Fitting Design

There are three basic classes of fittings to be considered, all of which involve the element of cost. These are: fittings for performance ships, that is, ships built for specific performance work such as record breaking; fittings for experimental ships; and fittings for production ships.

When an airplane is being designed and built for performance work, weight and compactness become vitally important, and conversely cost becomes of minor importance. Each individual fitting is then designed for the exact requirements imposed on that fitting; a large number of forgings and intricately machined parts are used so that not an ounce of extra weight remains. Such fittings obviously are expensive and not to be considered for ordinary airplane construction.

In designing and building experimental airplanes, usually only one or two airplanes are involved, although the probability that if the airplane is successful it might become a production airplane must be kept in mind. The budget for the airplane is usually fixed beforehand and therefore the design of fittings becomes a compromise depending on cost. Where there are many similar fittings on the airplane, forgings or castings may be used, but in general the fittings are designed for welded sheet metal construction or simple machined parts from bar stock. In all cases, however, the fittings whether of welded construction or machined should be so designed that with a minimum of redesign, they may be changed to forgings or castings.

The cost of production airplanes is of paramount importance and, therefore, the design of the fittings must be undertaken with minimum cost in mind. Wherever possible, fittings that must perform similar functions are made alike, although this means that many of the fittings may be over strong and consequently over-heavy for the purpose intended. Drop forgings, hand forgings, castings, sheet metal die fittings and machined fittings that can be produced on automatic or semi-automatic machines replace other types of fittings. The use of welded fittings or other fittings that require considerable hand work must be eliminated as much as possible. The degree to which the production type of fittings may be used depends entirely on the number of airplanes over which the cost of tools, dies, jigs and fixtures may be distributed. This factor must be considered at the time of design.

In the design of fittings, strength and weight are the primary requirements. However, many years of service have indicated that many other factors enter into the suitability of fittings. All fittings other than wire, cable and tie-rod anchorages should be designed to carry approximately 20% or more in excess of the design loads and in some cases depending on the vital functions of the fitting, the location in the structure, or the indeterminate stresses acting, the strength should be increased as much as 100% or more. This is good practice with fittings subjected to occasional vibration and particularly necessary on tail plane fittings of multi-engined aircraft where, when flying with one or more engines cut out, periodic vibration may be caused by the slip stream of the idling propellers.

The science of aviation dealing with a hitherto undeveloped line of endeavor has found it necessary to coin words and phrases descriptive of aircraft parts, assemblies, operations, and all the other various phases. To a great extent the influence of the French helped to formulate this vocabulary but the early pioneers, interested in building and attempting to fly airplanes, did not worry about such things as words and used whatever words came to mind that more nearly fitted their thoughts. The result has been the adoption of many words that in general have little meaning and in some cases border on slang.

The word "fitting" in general usage has many definitions but in aircraft usage has a very definite and concrete meaning. The NACA defines it as "a generic term for any small part used in the structure of an airplane or airship. If without qualification, a metal part is usually understood. It may refer to other parts, such as fabric fittings." In actual practice, however, the word is generally understood to mean a part joining two or more other parts such as fuselage to wing struts, engine mounts to wing structure, landing gear to fuselage, etc., in contra-distinction with other terms, such as generator bracket, radio support, instrument panel support, dynamotor base, etc.

Wire, cable and tie-rod anchorages should be designed for the rated strength of the wire, cable or tie-rod. The gauge of the metal and the outline of the fitting should be determined by careful study. The gauge should be heavy enough to give the required bearing area in the lugs and bolt holes without the use of welded washers or tubes. The heavier the gauge used in lug shanks, the greater the insurance against failure due to fatigue under vibration, or to rough handling in assembly and shipping.

Due consideration must be given to such factors as the necessary distances between bolts and rivets and the possibility of plates buckling under compression loads. The use of lightening holes should be studied with care to preclude the building up of secondary stresses. The use of eccentric fittings is to be avoided so far as possible, except where the use of eccentricity leads to a reduction in the stresses in adjoining members. Fittings which subject the attaching bolts or rivets to combined tension, shear and bending should be avoided. The radius of bends should be as large as possible to avoid cracking the metal.

All fittings subject to reversals of stress, pounding, angular movement, periodic vibration, or other conditions causing enlargement of holes should be provided with replaceable hardened steel bushings. Where replaceable bushings are impractical, the fittings should be made sufficiently oversize to permit reaming out for larger bolts.

Sheet Metal Fittings

The sheet metal fittings always has been and, at least for some time to come, will be the mainstay of the designer. The popularity of this type of fitting is mainly due to the wide variety of fittings that can be made at comparatively reasonable cost. The fittings may vary from plain single piece fittings shaped and bent by hand or die to large fittings of many component parts built up by welding or brazing. By careful design it is possible to fabricate almost all of the fittings used on planes from sheet metal.

In the early days of aviation the materials for sheet metal fittings consisted of any sheet metal the builder could lay his hands on. Black iron, blue iron, soft steel sheet and even tobacco tins or simi-

(*Continued on following page*)

VOUGHT FIGHTING CORSAIRS "ARMED" WITH GOODRICH TIRES FOR SAFE LANDINGS

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One of the modern, high-speed fighting units of the Navy. Equipped with dependable Goodrich Airplane Silvertowns.

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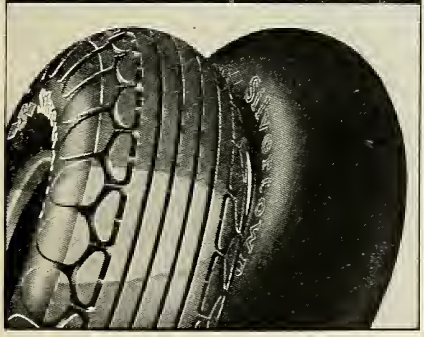
WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS



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Whether a landing field is soft and spongy or hard and humpy makes little difference to Silvertowns. With their large air volume and low air pressure, Silvertowns instantly adapt themselves to the terrain. They level out the humps. "Snowshoe" across the soft spots. And the plane itself is protected against excessive rebound and ground-loop tendencies.

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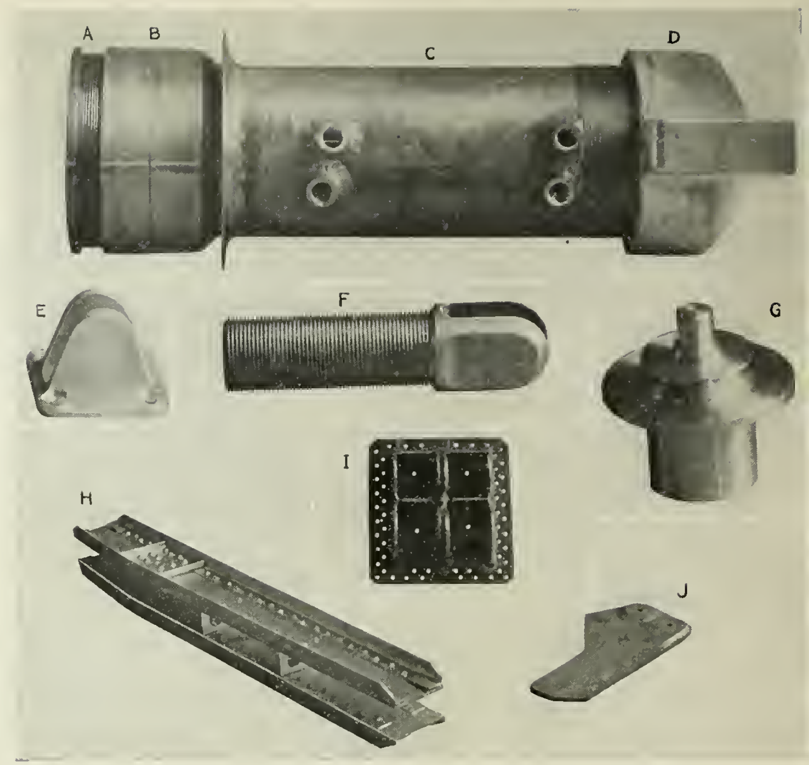
(*Continued from preceding page*)

lar containers were used. This period is sometimes referred to as the "stove bolt and bailing wire era."

The first material to come into almost general use was a cold rolled steel of low carbon content about equivalent to SAE steel 1010 and having an ultimate tensile strength of about 40,000 lbs./sq. in. This was an automobile body steel and was relatively easy to obtain and work.

SAE 1020 and 1025 steels were the first really standard steels for aircraft work and came into use through the agency of the Army and Navy. At first these materials were difficult to obtain as the quantities used and the strength requirements were such that few steel mills were interested in their manufacture. Finally the Government had to help out by buying large quantities of steel and selling to the aircraft manufacturers. These steels had an ultimate tensile strength of 55,000 lbs./sq. in. minimum.

By this time airplanes were becoming larger and also the automobile industry was developing alloy steels which appeared to have promise for aircraft work. There followed a period during which all kinds of alloy steel sheets were tried such as SAE 2330, 3130, and 6130. This period was full of grief for the constructor as some of the steels were poor for welding although they would be easy to heat treat; others welded beautifully but were tricky on heat treatment and some were poor on both welding and heat treatment. Also, the question of supply again entered the picture. The constructor in general became dependent on steel jobbers with the result that he had to take what he could get and then was not sure of what he had until a chemical analysis was made.



A—bronze casting after machining. **B**—fitting machined from steel bar. **C**—part welded up from steel tubing. **D**—steel casting after machining. **E**—fitting machined from dural bar. **F**—fitting machined from steel bar. **G**—dural forging after machining. **H**—typical dural construction. **I**—complicated welded sheet metal fitting. **J**—simple welded sheet metal fitting

The miscellaneous alloy period continued until the discovery of an almost unlimited supply of molybdenum in the western part of the United States. In a relatively short time X-4130 chrome molybdenum steel or chrome moly as it is commonly known, became the standard aircraft sheet steel and remains so to this day. This steel satisfies all the requirements of the aircraft constructor and has none of the drawbacks of the preceding steels. It welds easily, is capable of being readily heat treated, is simple to form or work, has a wide strength range, and is reliable in use. The ultimate tensile strength may be varied from about 70,000 to 180,000 lbs./sq. in.

Aluminum alloys are also used quite extensively for aircraft sheet metal fittings, especially the types known as 17S and 24S or more commonly as dural. These aluminum alloys have the strength of the SAE numbers 1020 and 1025 steels with only one third the weight. These alloys do not, however, have the wide range of design possibilities that the steel fittings have, due to the necessity of riveting the component parts of the fitting together, as welding changes the character of the alloys and reduces the strength around the weld.

From the weight saving standpoint, it is preferable to use aluminum alloy fittings wherever possible making due allowance, however, for the character of stresses imposed on the fittings and their ability to stand up in service.

Recently stainless steel sheet of the 18-8 type has come into extensive usage for sheet metal fittings particularly for flying boats and amphibions. The metal is highly satisfactory from the corrosion resistance standpoint and has good strength qualities except that the yield point is rather low. It is somewhat difficult to fabricate due to the phenomon of "work hardening" and is relatively harder to machine.

Other standard sheet metals such as Monel metal, nickel, nickel silver, magnesium alloys, brass, bronze, etc., are frequently used for sheet metal fittings where some peculiarity of the design or location requires their special properties.

The keynote for the design of sheet metal fittings whether of steel, dural or other materials, is simplicity. The number of component parts should be kept to a minimum and due attention paid to suitability for quantity production. This particularly applies to welded steel fittings where heat treatment for increased strength is employed, as the more com-

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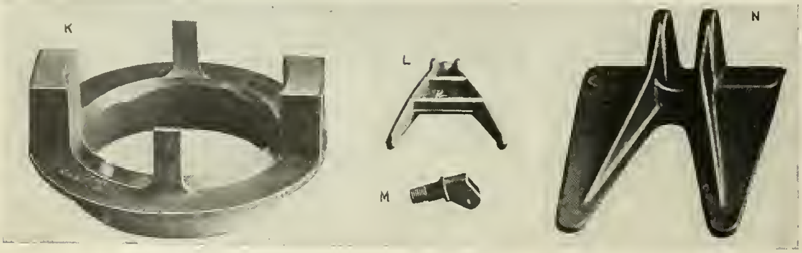

K—dural casting after machining. (Note the X-ray stamp.) **L** and **N**—steel drop forgings prior to machining. **M**—aluminum alloy die casting

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—after September 1, 1935—

(*Continued from preceding page*)

plex fittings are subject to distorting strains during the heat treating process that tend to crack the fittings or entail considerable expense in keeping the fittings true to dimensions. Also, even though heat treating is not used, all welded fittings should be normalized to remove welding strains and the normalizing operation has the same undesirable effects as the heat treating operation.

It is advantageous to subject highly-stressed, important structural, welded, steel fittings to the Magnaflux test for cracks and defects. The results of these tests should only be interpreted by experienced personnel, however, as very frequently Magnaflux formations that appear to indicate defects are in reality caused by the design of the fitting.

In designing high strength steel fittings requiring the use of heat treating, it is well to keep in mind the usage for which the airplane is intended. In commercial airplanes, particularly those in the lower price category, service is usually taken care of on the home field and, if such a heat treated fitting should require replacement, it is probable that the replacement fitting may not be suitably heat treated or not heat treated at all with the resultant decrease of strength and possibility of failure in flight.

Drop Forged Fittings

Probably the most satisfactory type of fitting for aircraft usage is the drop forging, if a sufficient quantity of the forgings may be made to justify the cost of the dies. The material becomes strong, dense and tough and gives an unexcelled life in service. Practically all of the materials used for aircraft fittings are suitable for drop forging although X-4130 steel and aluminum alloys are most commonly utilized. Forgings are entirely suitable for almost any type of stress that may be imposed such as tension, compression, shear and bending and also due to the fine structure of the material they have great resistance due to vibration fatigue. All aluminum alloy forgings must be heat treated to render the proper strength and to furnish suitable resistance to corrosion. Steel forgings should be heat treated to obtain the maximum strength-weight ratio suitable for the design as they are not likely to be subjected to home-made replacement in the field as sheet steel fittings are.

The design of forgings is simple providing a few simple points are followed. The amount of draft for a drop forging die varies from 3° to 10°. If the die is for a thin forging of uniform section, 3° is ample, but if the forging is deep and has narrow ribs which are apt to stick, at least 7° is necessary. If a die is used for forging a piece that is ring-shaped or has an annular part, the central plug that forms the interior of the ring should have a draft of 10°, because, as the forging cools while being worked, it tends to shrink around the plug and if the draft is insufficient, it will stick in the die. In general, however, a 7° draft is suitable for most dies. Abrupt changes of section should be avoided to remove the possibility of stress concentration and liberal radii should be used for the same reason. Hand or rough forgings are useful where the size precludes the use of dies or where the partial forging saves material and labor in machining.

Castings

Castings form one of the earliest and most useful types of aircraft fittings, but at the same time, are a type that require careful design and must be confined to parts of the airplane where failure in flight would not be serious.

The first materials to come into use were the bronzes such as manganese bronze, tobin bronze, aluminum bronze, phospher bronze, gun metal, naval brass and similar compositions. Next the aluminum alloys and lately, steel. The bronze alloys, properly cast by a reputable foundry, give good results in service; however, the stronger types, such as manganese bronze and aluminum bronze, are hard and costly to machine and are subject to blow holes, porous spots and inclusions so that the percentage of rejected fittings runs high.

Heat treated aluminum alloys now form the most used type of casting mainly because of the weight saving, the dependable source of supply and the general all-round usefulness of the material. The magnesium types of aluminum alloys are used mainly on engines and land planes, as magnesium is highly susceptible to salt water corrosion. The use of the magnesium alloys has been practically discontinued for seaplanes and amphibions because of the expense and trouble to protect the fittings from salt water action.

Steel castings were tried and discarded years ago because of the unsoundness of the castings. Lately, however, they are coming back into favor, as due to the requirements mainly for trucks and heavy vehicles, the steel foundries have perfected materials and methods and can now furnish good, sound castings with ultimate tensile strengths available from 60,000 to 125,000 lbs / sq. in. Such castings are sometimes used in the structural parts of the airplane but are mainly confined to landing gear and tail wheel parts.

In designing castings, the location where they are to be used has more direct influence on the design than probably any other type of fitting. In general, it is preferable not to use castings in any part of the primary structure and, although it is the easiest, any part of the control system. This last, however, is not generally followed and a few castings are usually to be found. However, the strength is at least and usually more than 100% of that calculated to be required.

Castings should not be designed with lugs attaching to struts and wires exposed to the air stream or to parts subject to vibration such as engine mounts, also lugs which might be subjected to accidental bending stresses during assembly, disassembly, or alignment. Castings should never be used for attaching any major assemblies of the airplane. In designing castings, the following conditions should be avoided: high stress concentrations, reentrant angles between surfaces forming pockets and corners where castings may develop porosity or cracks due to shrinkage and air bubbles, slender cantilever lugs, and sharp corners. Generous filleting should be provided. It should be kept in mind that aluminum alloys and brass castings have a shrinkage of approximately 7/32″ per ft., bronze approximately 5/32″ per ft., steel 3/16″ per ft. and that a draft of from 1/32 to 1/16 and sometimes as great as 1/8″ per ft. must be provided depending on the size and shape of the casting. Castings that have any importance whatever should be X-rayed to be certain that they do not contain any internal defects.

For quantity production of airplanes and especially for parts of engine and allied controls the die casting has found great favor. Although the die cost is high, there is usually so little machining required that the unit cost is comparatively low in average production quantities. The materials suitable for die castings are not suitable for strength, however, and, therefore, die castings may only be used where failure is not harmful nor of importance to safety.

Machined Fittings

Under this heading come all fittings, machined from rods, bars, billets, hand forgings, tubing, and allied forms of materials. This type of fitting constitutes the general run of fittings for structural strength purposes. The materials may be any of the materials given under the other types of fittings.

As in drop forgings or castings, abrupt changes of section should be avoided and liberal radii should be provided to avoid concentration of stresses. The same considerations should be given to heat treatment as mentioned under the heading Sheet Metal Fittings as it is always possible that an unheat treated replacement part may be used with serious consequences.

The major factor in design next to strength is simplicity so as to keep the cost down. Due to the amount of machining sometimes necesary, the cost of these fittings may run into almost prohibitive figures. The designer must be fully acquainted with the shop equipment where the fittings are to be machined and must exercise care to see that it is possible to produce the fittings with the equipment available.

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WOOD

In Modern Aircraft Construction

●

T. C. BENNETT

Wooden construction cannot be advanced as a cure-all for every structural and fabrication difficulty, any more than can any other single material. It should, however, be considered without prejudice, full recognition given to its characteristics, full advantage taken of its possibilities.

● Contrary to popular belief in this country, wood for airplane construction is not so much a dead material, as it is an unfashionable one. Very good airplanes have been built of wood, the best known of which is the deHavilland *Comet,* winner of the MacRobertson Race from England to Australia.

Some of the excellent performances of high speed airplanes are due to the absence of roughness, irregularities and indentations on the wings and fuselage, and plywood lends itself particularly well to the smoothness of surface and line required to reduce drag to a minimum.

One of the advantages of wood construction is the fact that surface coverings can be applied from one side only, being glued and nailed into place. With wood construction subsequent parts are always applied *from the outside,* to the benefit of economical aircraft construction.

One aircraft firm developed an excellent method of fabricating with plywood. Ribs were assembled, and thin sheets of plywood were then fastened to the substructure by using an ordinary office stapler similar to the type frequently used in drafting rooms for fastening drawings to the boards. In the case of a wing covering, the sheet of glue-covered plywood is held in place by one man while another man goes along the seam with the stapler, and fastens the plywood in place with unclenched wire staples. As soon as the glue has set, the staples (which are visible) are removed by hand, thus leaving a clean, smooth surface upon which it is easy to get the high finish which increases not only performance and greatly improves appearance, but also sales appeal in the finished product. The staples which were out of sight in the ribs and the inside of the fuselage, are permitted to remain, not for any reason of strength, but to save an operation. The final result is a job which is impressive from a fabricating point of view.

An objection frequently voiced against wooden structures is that they appear to be invariably heavier than if the structure had been made of metal and fabric. The usual basis of comparison between the various aircraft materials is to express the ratio of tensile strength to unit weight, and take the resulting number as an index of efficiency in placing the various materials in their order of merit. On such a basis, strong materials such as the high-strength steels, appear much superior. The only objection to such a basis of comparison is that one so seldom has a chance to make all the members of a structure, particularly an airplane, act in tension.

If plywood is to be used in aircraft construction it must be utilized as a strength member, just as is the metal covering of wings, in order to keep weight as low as possible. It appears that plywood is more advantageous than dural and other materials when an analysis is based on a study of the critical crippling stress.

Of course, figures of crippling stress do not indicate the entire story, for no single criterion has yet been established which can rank materials in their order of merit. Each case must be decided after consideration and proper weighing of th factors involved, and a compromise i necessary in all practical cases. Figure on the other hand do indicate that plywood and wood may be justly considere to be as favorably reported as other materials when modern aircraft structure are being designed. It is more important that a material have low densit rather than low weight-strength ratic This point must be recognized wheneve monocoque structures are being considered, for it allows the elimination o many local stiffeners and reduces th number of detailed parts to be manufactured and joints to be assembled.

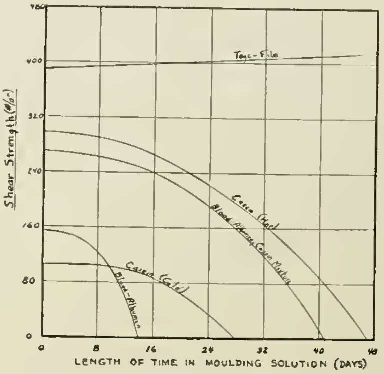


Fig. 1. Plywood's resistance to mold

Some of the major points advance against the use of wood have been th lack of homogenity of the material, th varying strength characteristics, and th effect of uncontrolled moisture upo wood. Plywood in many cases ha eliminated the argument of non-homogenity and varying characteristics; it ha not entirely eliminated the effects o moisture. Casein glues were found t be far superior for use in the formatio of plywood, and also for making up woo joints. It was particularly good fo shop use as it could be applied cold i desired. However, with casein glue uncontrolled moisture was added to th originally kiln-dried wood sheets.

One of the interesting modern developments to avoid this difficulty utilizes method whereby sheets of phenolic resi film are placed between the plies and hea and pressure are applied. An excellen piece of plywood is producd with no increase in moisture content, one which i more impervious to moisture and mol effects than any other type, and havin excellent strength characteristics.

Mold or Fungi Test

All modern aircraft plywood is required to meet satisfactorily the mol or fungi test in which alternate strip of wood and potato are placed on a bric in a jar partially filled with water. Th culture is kept for ten days, at 90° F in a dark place but exposed to the air Then the culture is broken down an strips of plywood to be tested are interlarded between the strips of potato an wood. The entire thing is kept for another ten days at 90° F., after which i is washed and the plywood strips teste in shear, in which they must develop 250 lbs./sq. in. The same plywood must develop 300 lbs./sq. in. in the normal o dry state and 250 lbs./sq. in. after soaking in water for 48 hours.

The ability of resinous film plywood t resist mold and fungi is shown by the generalized curves in figure 1. These indicate the strengths of specimens with the various types of glues and illustrate strikingly the superiority of the resin film plywood. These specimens were subjected to a mold test substantially the

Haskelite photo

Attractive plywood panelling in the Sikorsky S-42 "Clipper Ship"

same as that described previously.

The photograph in figure 2 shows the effect of mold on a specimen of ordinary three-ply birch which had been in the mold culture for 155 days. The glue has completely disappeared from a great portion of the surface, while the corresponding piece of resinous film plywood apparently was unharmed.

An appreciable part of the objection to wooden construction from the standpoint of deterioration is based on experience in which the glue itself has failed, and proper differentiation has not been made between failure of the wood and of the binder. The wood of the specimen shown, while not tested for strength, is probably capable of developing a large proportion of its original strength.

A comparison of the strength characteristics of three-ply birch glued with ordinary glue and with resinous film, as determined by test is given below (in lbs./sq. in.). The latter specimens were tested in order to determine the value of *E*, or Young's Modulus, along, across, and at 45° to the face ply. The results indicate that while stress is proportional to strain for a considerable range in the first two directions, the same is not true for the diagonal tension. The resinous film test results are based on only two specimens and so the values obtained are probably not satisfactory for use in design without further check. The other values shown are based on the average of a large number of test samples and are, therefore, more reliable.

	Ordinary Glue	Resin Film
Along the grain, stress at failure	13210	16750
Along the grain, E	2.26×10^6	1.55×10^6
Across the grain, stress at failure	7700	9310
Across the grain, E	197×10^3	990×10^3

An interesting development in the use of wood is that of case-hardening propellers by a process somewhat similar to that with the resinous glue film plywood. Propellers finished with the Schwarz process have skins so tough that they cannot be dented by husky hammer blows, and are impervious to flying stones, heavy rain, heavy spray, and corrosion. In Germany, where the process originated, a life of 1000 hours, is guaranteed by the manufacturer. The normal life of a wooden propeller in a flying boat due to the heavy spray is about fifty hours, but recent tests on a British flying boat showed the new propellers undamaged after 500 hours, and still suitable for service. The covering so completely seals the propeller that the wood is unaffected by changing humidity conditions.

The propeller to take the Schwarz process is shaped just as any wooden propeller except that the blades are covered with a coarse fabric and a metal leading edge capping strip is attached which carries with it narrow strips of brass gauze.

Finishing the Propeller Surface

Sheets of non-inflammable celluloid after being softened in acetone are wrapped about the blades after an adhesive has been applied. Tight fitting rubber bags are then drawn over the entire propeller and the whole is subjected to a pressure of 50 to 100 lbs./sq. in. The propeller is then removed and held at drying temperature for several days in order to drive off the remaining acetone and to harden the surface. The surface is then smoothed and polished giving a very fine finish which can be painted.

Some of the Advantages

Some of the advantages of the process aside from the increased life of the propeller appear to be that it increases the torsional resistance of the blades and thus enables use to be made of thinner and lighter blade sections. It also appears possible to use woods other than mohogany. According to reports experiments are being performed to adapt the wooden blades to fit into metal hubs for use with adjustable and controllable pitch propellers. Laboratory tests at Aldershot, Germany, indicated that it was not possible to loosen the wooden blade in its steel sleeve even when the alternations of load were carried to 35×10^6 reversals with an actual torque load up to ten times that of the engine for which the propeller was designed.

Space prohibits a discussion of the many matters pertinent to wooden construction. The problem of deterioration is being solved and improvements along this line may be expected in the near future. In addition to the phenol type resins, the vinyl esters, the glyptal and the urea resins are being considered for their possibilities as wood adhesives. Several firms have developed metal and wood combinations which have possibilities for aircraft construction.

Familiarity with design problems and design methods brings one to the conclusion that wooden construction, if properly and intelligently conducted, need suffer no disadvantage either from the strength or weight standpoint. Further, it possesses definite advantages from the point of ease of fabrication, and of cheapness of the original material.

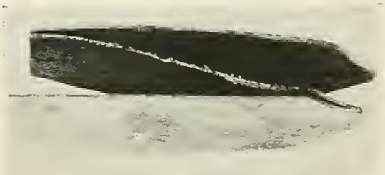


Fig. 2. Effect of mold on plywood

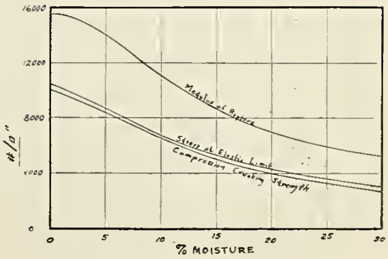
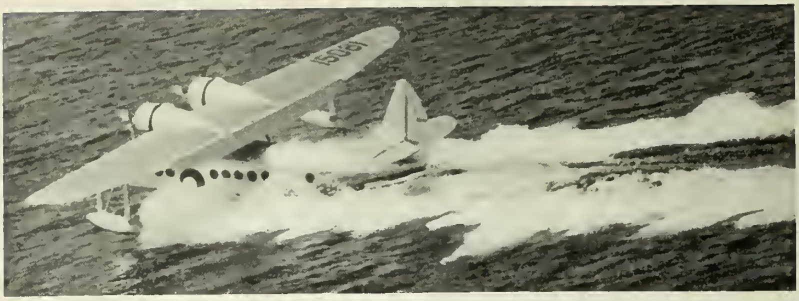
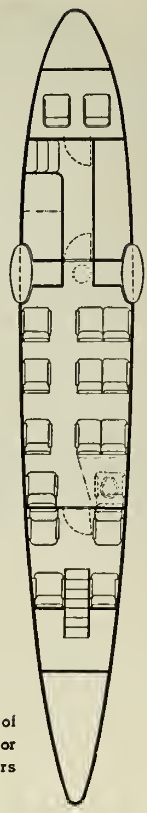


Fig. 3. Effect of moisture content





Arrangement of the seating for 16 passengers

Design and Construction Details of the New Sikorsky S-43 Amphibion

Technical data on Sikorsky's latest type passenger amphibion, the first of which was delivered to Inter-Island Airways for use in the U. S. Territory of Hawaii, as depicted in the cover design of this issue

● The new Sikorsky S-43 is a 16 to 25 passenger, high wing, cabin monoplane amphibion with structural features based on the development of its predecessor, the S-42. Powered by two Pratt & Whitney S1EG geared Hornet engines which deliver 750 h.p. each at 7000 ft., and driving two Hamilton Standard constant speed propellers, this amphibion shows performance and efficiency usually associated with landplanes.

The highly efficient airfoil of the NACA 22 series, tapers in plan and section from the center section to the tips. This semi-cantilever wing, constructed in three separate panels, utilizes a single box type metal spar having numerous continuous extruded reinforcing flanges and heavy flush riveted surface covering. The leading edge and central portion of the wing are covered with 24ST and the portion aft of the box spar is formed sheet ST covered with fabric. The forward location of this torsionally-rigid spar produces a coincidence of the wing aerodynamic center with the elastic axis. For access to engine controls, the entire leading edge is removable, being attached by means of screws. Ribs are of sheet dural. Easily removable inspection doors are provided at major points, and landing lights are built flush into the leading edge.

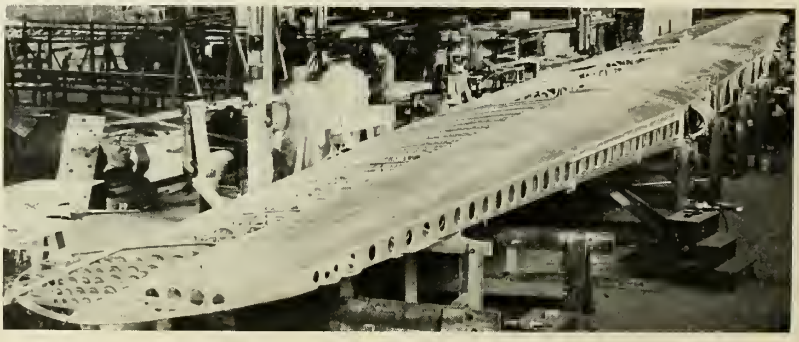
The wing trailing edge flap, of fabric-covered 24ST, is a single unit extending between the ailerons and is supported on 7 outside hinges, employing self-aligning ball bearings. It extends for a distance of 48% of the wing span and 20% of the wing chord, is mechanically actuated by means of hydraulic pistons operated electrically or manually. An oil pump driven by an electric motor operates the oil pistons for the wing flap, the retracting landing gear and aileron; auxiliary hand operation is provided. The flap may be set at proper angles for either slow landing speeds or short take-off runs, and an automatic return to neutral position provides against excessive air loads.

Statically balanced ailerons, each carried on 3 outside hinges, are constructed similar to the flap. Both wing tips for a distance of 5 ft., (or beyond the ailerons) are watertight to provide emergency flotation, yet the ship would list 13.5° before the tips would touch water.

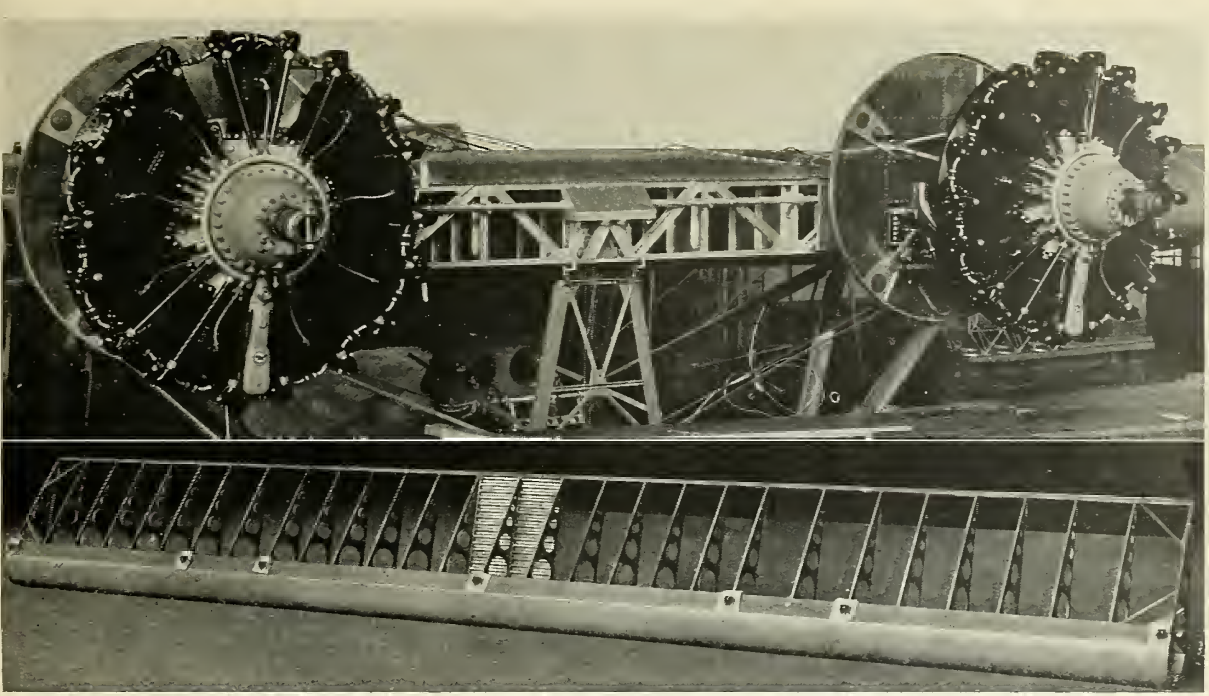
Keel-less Hull

The hull is of the keel-less type, measuring 50 ft. 3 in., in length, with a maximum beam of 90 in., and a minimum interior height of 72 in. Its structure is all-metal semi-monocoque, built up entirely of open sections, to assure detection of corrosion and to facilitate maintenance and inspection. In the hull design there are no straight longitudinal lines. The pointed determination of the step prevents the ship from hunting before she gets on the forward step and facilitates quick take-off on one engine. The forward angle of the keep is 0°, and the after angle, 8°. The angle of trim is 2.75°, and the angle of list, 13.5°.

All members and plating are protected against corrosion by the anodic process. Flush type rivets connect the internal longitudinals to the deck, bottom platings, and transverse frames. Four main bulkheads with watertight doors divide the hull into five separate



Uncovered wing with leading edge removed to show wing spar structure



Center panel with engine mounts, and below it part of the wing flap before covering with fabric

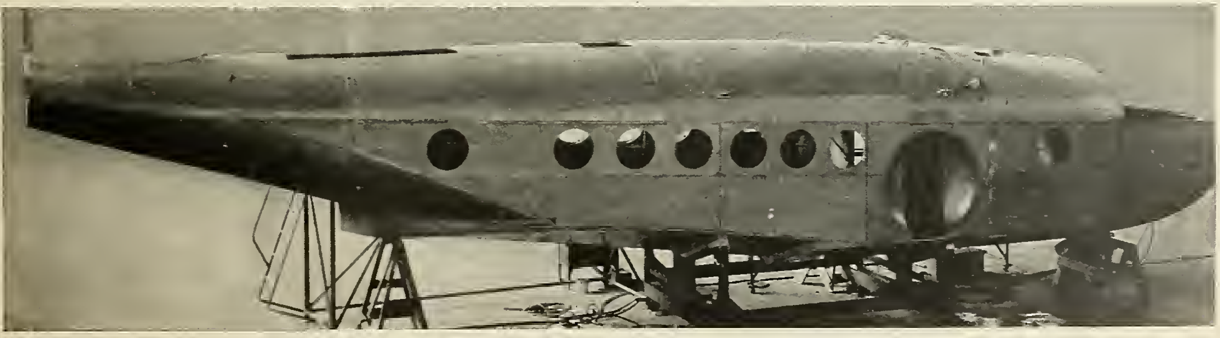
watertight compartments, any three of which will float the airplane. The watertight landing gear compartment occupies a relatively small part of the interior space.

Fairing between wing and hull is nonstructural and is readily removable for servicing the controls and electric wiring. It is designed to eliminate interference between the hull and wing; tests showed that the combined hull and wing has less interference and parasite drag than the sum of the two items.

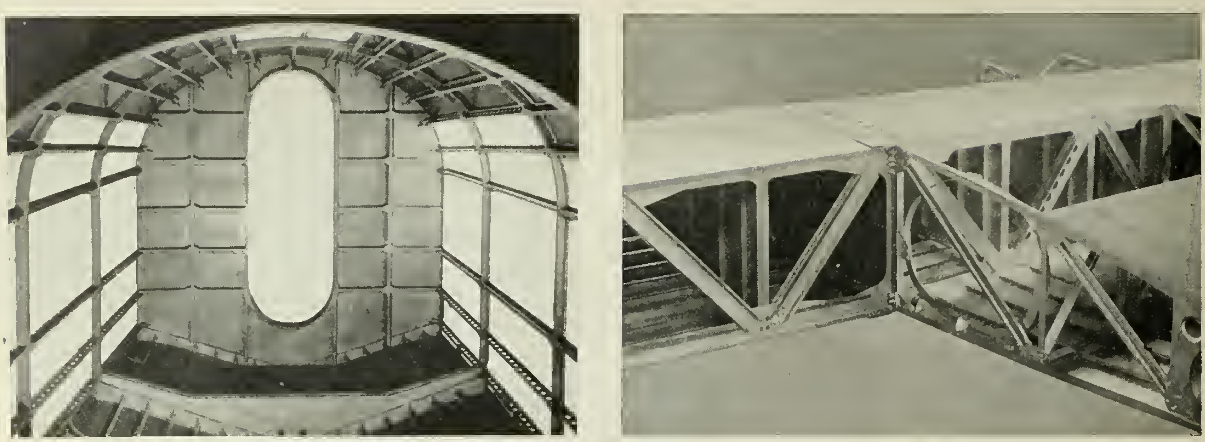
Wing tip floats are of similar construction to the hull, having tranverse bulkheads, and a single step. Each has a displacement of 1300 lbs., and a submerged angle of 7° with the water line. Floats are centered 24′-9″ from the main hull centerline. They are braced with streamline wires and stressed to withstand a float-first landing at 50 m.p.h.

Adjustable pilot seats in a roomy cockpit combined with a carefully designed windshield provide unobstructed vision about the horizon and under the wing. The windshield design eliminates glare and reduces rain blanketing. The deck of the hull forward of the pilots compartment, as well as the inside of the stainless steel window frame, are painted dull finish black to eliminate glare. A wheel type control column is provided for each pilot. Engine control handles for the two engines are mounted overhead between the pilots and operate with a fore and aft straight line motion. The dual split-spade-handle throttle control incorporates a vernier adjustment for engine synchronization and is provided with friction locks. The indirectly lighted instrument panel is mounted on Lord shock absorbers. Two complete sets of flying instruments are mounted on individual panels which are detachable as units from the main panel for servicing and calibrating. Electrical switches, fire extinguisher control, fuel gauges, and engine instruments are mounted on the main panel. Provisions are made for immediate installation of an automatic pilot and for any type of radio equipment. Two 12-volt Willard batteries of 50 ampere hour capacity are installed.

Sliding side windows provide a means for wiping the windshield in flight. Seats, flooring, rugs, paneling and soundproofing are quickly removable for cleaning and maintenance. Marine equipment in the bow compartment includes an especially designed non-magnetic anchor. A large hatch is provided in the bow to facilitate moorings. An entrance hatch is provided in the cabin aft of the pilots'



Hull unit showing double steps and unusual bottom lines which facilitate take-off



Hull structure formed of open sections and details of wing showing tank recess

compartment and another near the rear of the hull, accessible by means of a portable metal step ladder.

Tail surfaces with a span of 22.5 ft., are of metal structure with fabric covering, strut-braced to the hull. The outer sections of the horizontal tail surfaces are flat on top and the bottom surfaces tapered, resulting in a dihedral assisting stability. The stabilizer is adjustable from + 4° to — 4° by means of a worm gear mounted in the rear of the fin. Elevators are dynamically balanced and carried on ball-bearing outside hinges. The rudder, balanced by means of an automatic trailing edge tab, shows a balance coefficient of .73 against the U. S. Department of Commerce requirement of .8.

Landing Gear Arrangement

Landing gear and tail wheel are retractable in approximately twelve seconds. Welded steel tube construction is used for the retracting mechanism with left and right units interchangeable and readily removable for converting the amphibion into a flying boat. The entire landing gear mechanism weighs 1000 lbs. Forty-five inch General *Streamline* 45 lb. pressure tires and oleo-spring shock struts absorb the landing loads. Each main wheel with its cast aluminum hub weighs 200 lbs. When retracted the wheels recess into the hull until only half exposed, since wind tunnel tests showed that complete enclosure gave no measurable increase in performance. The tail wheel, swiveling 360°, uses an 18″ × 6″ low pressure tire.

The shock strut is operated simultaneously with the landing gear. Wheel brakes are hydraulically operated and are connected with the rudder pedals. Braking mechanism is designed to function effectively even when wet. The sliding rudder pedals are adjustable; the brake pedals are mounted on the rudder pedals, and a hand parking brake is provided.

Excessive friction, lost motion, and abnormal wear are eliminated by the use of sealed ball bearings for all pulleys and levers in the control system. All control surfaces are cable controlled and provided with numerous inspection doors and easily-serviced hinges.

The two Pratt & Whitney air-cooled radial engines are installed on vibration-dampened engine mounts of conventional welded steel tube construction. Each mount is connected directly to the front face of the wing beam at 4 points, and to the engine by means of 9 rubber-bushed bolts placed so as to absorb engine vibration tangentially. The interchangeable mounts, complete with engine accessories, fire wall, and engine control jack shaft, are easily disconnected at the wing beam supports.

Two riveted duralumin elliptical section fuel tanks of 100 gallons capacity each supply each engine. Electric gauges, stick gauges, and metering dump valves are built into each tank. Valve control is remote and tanks are interchangeable. Welded aluminum oil tanks of 22 gallons capacity each are cradled on the wing upper surface at the front beam web under the nacelle cowling. Oil radiators are provided. Nacelle cowlings are built in sections to permit easy servicing of the power plant unit. Lux pressure fire extinguishers are mounted in each nacelle and controlled from the cockpit. Convenient steps, hand-holds, and work platforms, which fold into the wing leading edge when not in use, provide ready means for servicing.

The Solar exhaust rings have ports above and behind the NACA cowls.

In addition to the lavatory, electrical and buffet equipment, the following standard equipment is installed:

Instruments: 2 air speed indicators; 2 altimeters (sensitive); 2 turn and bank indicators; 2 rate of climb indicators; horizon indicator; 2 directional gyro compasses; 2 magnetic compasses; eight-day clock; 2 tachometers and shafts; 2 supercharger pressure gauges; 2 oil pressure gauges; 2 fuel pressure gauges; 2 oil temperature gauges; 4 fuel quantity gauges; voltmeter; ammeter; 2 engine temperature indicators; twin engine ignition switch; landing gear position indicator.

Power plant equipment and accessories: 2 engine-driven fuel pumps; 2-11.5 ft. constant r.p.m. variable pitch propellers; 2 oil coolers; 2 direct-drive electric

(Continued on following page)

The Sikorsky S-43 on land with front and rear hatches open

The SIKORSKY "S-43"

IS EQUIPPED WITH

PRECISION BEARINGS

Where the bearings must not fail—on land, at sea, or in the air—NORMA-HOFFMANN PRECISION Bearings are the choice of engineers and designers of planes, engines (including superchargers), engine accessories control apparatus, instruments, radi equipment, cameras, and landing fiel equipment. Write for the Catalog. L our engineers work with you.

●

THIS new twin-motored amphibion—the first of ten being built by Sikorsky Aircraft Corporation for Inter-Island Airways and Pan-American Airways—is equipped with **NORMA-HOFFMANN PRECISION** Bearings in the control surface hinges and in the tail wheel assembly. **NORMA-HOFFMANN PRECISION** Bearings are also employed at various points in the two 750 H.P. Pratt and Whitney engines· in the Sperry Directional Gyro and Gyro

ve built up a store of knowledge which embraces not only design and fabrication, but also methods for the inspection of parts and testing of complete instruments which insure the utmost in accuracy and reliability. ∗ From a modest beginning in 1919 the Pioneer plant has become the largest in the world, devoted solely to the manufacture of Aircraft Instruments. Pioneer offers the most complete assortment of instruments suitable for every type of plane and every type of flying. ∗ The Pioneer representatives listed below offer complete service facilities: Bredouw-Hilliard Aeromotive Corp., 334 Richards Road, Municipal Airport, Kansas City, Kansas. Pacific Scientific Co., 37 Spear Street, San Francisco, California, also 1206 Maple Avenue, Los Angeles, California. Standard Aircraft Equipment Company, Hangar "D", Roosevelt Field, Garden City, L. I., N. Y.

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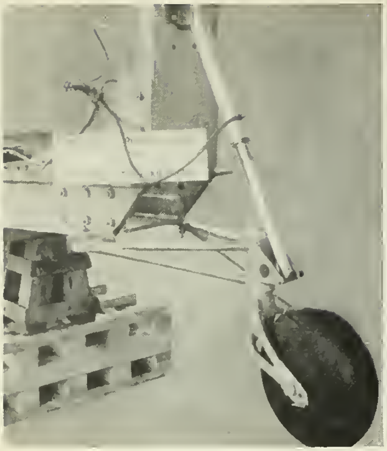
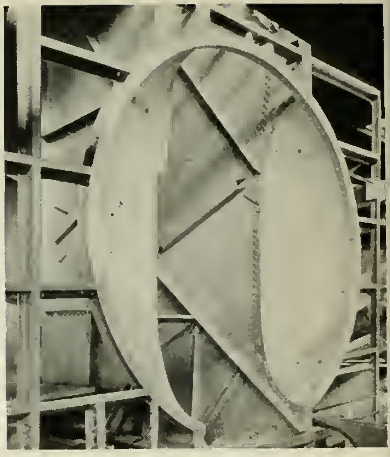


Tail wheel set up for test

(Continued from preceding page)

starters; engine driven vacuum pump; 2 sets engine radio shielding; engine generator drive; 2 engine tachometer drives; 25 ampere generator; generator control box; 2 starter handles; 2 electrical booster coils; 2 engine cowling rings; 2 fuel strainers; 2 exhaust collector rings. *Airplane equipment:* set of pressure extinguishers; 2 hand fire extinguishers; safety belts for crew and passengers; Very pistol with holder and cartridges; 2 engine tool kits; tail wheel, tire and tube; fire ax with holder; first aid kit; mooring post; towing pendant; heaving line; utility rope; ship's anchor; anchor holder; anchor rope; fog horn; fog whistle; boat hook; canvas bucket; book holder; tool box; 2 wheels and brakes; set of removable passenger chairs; cabin carpet or rubber walkway; locks for entrances; set of special tools; 2 engine instruction books; airplane instruction book; airplane log book; pilot's log book; set of life jackets; 2 tires and tubes; hand bilge pump; 2 canvas fenders; license frame; 2 engine covers; 2 propeller covers; 2 engine log books.

The S-43 has a total suhmerged displacement of approximately 50 tons, and an approximate righting factor of 3.6. Its specifications and performance figures are as follows:



Retractable landing gear well

	Standard Arrangement		Max. Pass. Capacity		Long Range Mail	
	Amphibion	Flying Boat	Amphibion	Flying Boat	Amphibion	Flying Boat
Range (mi.) 1000′ alt., 70% b.h.p.	750	1,000	390	675	2,000*	2,500*
Gross weight (lbs.)	17,541	17,541	17,541	17,541	17,850	17,850
Weight empty (lbs.)	9,821	9,071	10,019	9,111	9,686	8,736
Useful load (lbs.)	7,720	8,470	7,522	8,430	8,164	9,114
Crew (170 lbs. ea.)	3	3	2	2	3	3
Fuel (6 lbs./gal.)	400	550	210	360	925	1,083
Oil (7.5 lbs./gal.)	24	24	24	24	64	64
Pass. (170 lbs. ea.)	15	15	25	25	...	...
Baggage (lbs.)	750	750	750	750	90	90
Mail & express (lbs.)	700	550	...	...	1,000	1,000
Equipment (lbs.)	630	630	750	750	514	514

*Based on 12,000′ altitude at 165 m.p.h.

ced and carried on [illegible] outside hinges. The rudder, balanced by means of an automatic trailing edge tab, shows a balance coefficient of .73 against the U. S. Department of Commerce requirement of .8.

Outline dr

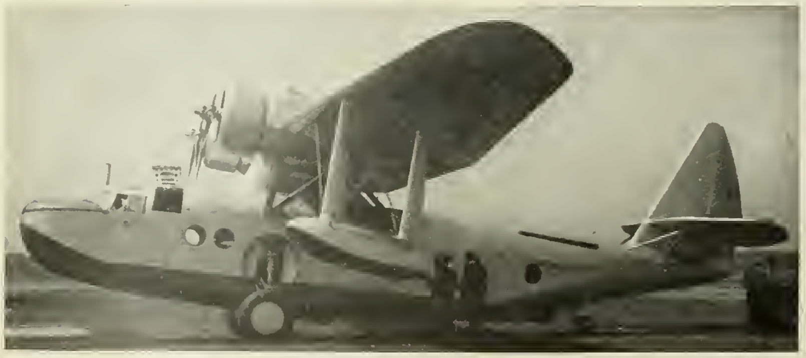
Landing Gear Arrangement

Landing gear and tail wheel are retractable in approximately twelve seconds. Welded steel tube construction is used for the retracting mechanism with left and right units interchangeable and readily removable for converting the amphibion into a flying boat. The entire landing gear mechanism weighs 1000 lbs. Forty-five inch General *Streamline* 45 lb. pressure tires and oleo-spring shock are connected with

Braking mechanism is designed to function effectively even when wet. The sliding rudder pedals are adjustable; the brake pedals are mounted on the rudder pedals, and a hand parking brake is provided.

Excessive friction, lost motion, and abnormal wear are eliminated by the use of sealed ball bearings for all pulleys and levers in the control system. All control surfaces are cable controlled and provided with numerous inspection doors and easily-serviced hinges.

The two Pratt & Whitney air-cooled radial engines are installed on vibration-dampened engine mounts of conventional welded steel tube construction. Each mount is connected directly to the front face of the wing beam at 4 points, and



The Sikorsky S-43 on land with front and rear hatches open

Specifications

ig span	86 feet
ght overall	17 feet 8 inches
gth overall	51 feet 2 inches
ig area	780.6 square feet
izontal tail area	127.6 square feet
ical tail area	61.75 square feet
el tread	11 feet 2 inches
imum chord	11 feet 6 inches
dral	2°
n aerodynamical chord	117.2 inches
le of incidence at root	3°
er loading	11.7 lbs./b.h.p.
ig loading	22.47 lbs./sq. ft.
uising speed 75% b.h.p.	
t sea level	167 m.p.h.
t 1000 ft.	165 m.p.h.
t 8000 ft.	181 m.p.h.
aximum speed	
at sea level	186 m.p.h.
at 7000 ft.	200 m.p.h.
at 7000 ft. (one engine)	125 m.p.h.
talling speed sea level	65 m.p.h.
ate of climh	1250 ft./min.
ervice ceiling	20 000 feet
one engine	7,000 feet
Take-off distance	
from land	800 feet
from water	1200 feet
Take-off time	
from land	20 seconds
from water	30 seconds

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indicato
horizon
compas
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Pow
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1928
1929
1930
1931
1932
1933
1934
1935

PIONEER

Clock
Flares
Switch
Octant
Ammeter
Compass
Voltmeter
**Altimeter*
Venturi Tube
Thermometer
Accelerometer
Suction Gauge
Warning Units
Turn Indicator
Drift Indicator
Bank Indicator
Pressure Gauge
Climb Indicator
Fuel Level Gauge
Sensitive Altimeter
**Tachometer, Electric*
**Air Speed Indicator*
Straightflight Compass
Tachometer, Centrifugal
**Manifold Pressure Gauge*
Vibration Absorbing Mounts
Autosyn Remote Indicating System
Pitot Static Tube, Electrically Heated
** Available with rotable dial*

Please indicate on the above list, the items concerning which we may send you complete information.

From drafting table to shipping bench, at every stage of manufacture, Pioneer's sixteen years of experience adds superior performance and reliability. When you buy Pioneer Instruments, you buy a share of this experience. ∗ Many years spent in research and manufacture have built up a store of knowledge which embraces not only design and fabrication, but also methods for the inspection of parts and testing of complete instruments which insure the utmost in accuracy and reliability. ∗ From a modest beginning in 1919 the Pioneer plant has become the largest in the world, devoted solely to the manufacture of Aircraft Instruments. Pioneer offers the most complete assortment of instruments suitable for every type of plane and every type of flying. ∗ The Pioneer representatives listed below offer complete service facilities: Bredouw-Hilliard Aeromotive Corp., 334 Richards Road, Municipal Airport, Kansas City, Kansas. Pacific Scientific Co., 37 Spear Street, San Francisco, California, also 1206 Maple Avenue, Los Angeles, California. Standard Aircraft Equipment Company, Hangar "D", Roosevelt Field, Garden City, L. I., N. Y.

PIONEER INSTRUMENTS

PIONEER INSTRUMENT COMPANY INCORPORATED
BROOKLYN • NEW YORK • A SUBSIDIARY OF THE BENDIX AVIATION CORPORATION

NEW EQUIPMENT and METHODS

New AVR-7A aircraft receiver

RCA Aircraft Radios

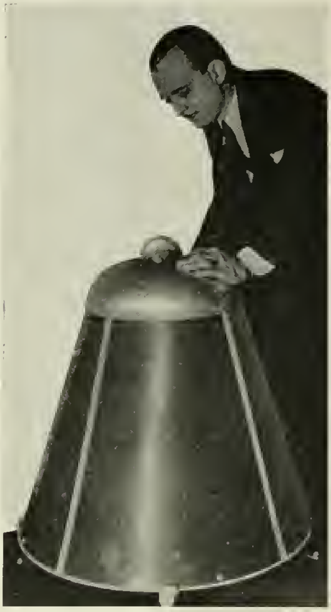
• AMONG THE new instruments produced by the RCA Manufacturing Co., Camden, N. J., is a compact light-weight and low-cost receiver which is available in a choice of two wave-band reception combinations, either to receive the beacon and entertainment bands (RCA Model AVR-7) or the beacon and communications bands (RCA Model AVR-7A). Each is a superheterodyne receiver equipped with four multi-function RCA tubes giving the equivalent of six-tube performance, with a resultant lower primary power drain. The receiver case, with built-in *B* and *C* power supply unit measures 8¾" × 6¾" ×9⅛", and weighs 16 lbs., 10 oz. It is remotely controlled by mechanical cable from a unit which fits into the small, unused spaces on the instrument panel. It requires only standard aircraft dry cells or storage batteries for its current drain.

In addition, the company has a new aircraft transmitter (RCA AVT-3A), of 20 watts power output and weighing 38 lbs. It is a single-unit transmitter designed and constructed to meet the requirements of aircraft communications. During flight, it offers the pilot a choice of three types of emission including telephone, continuous-wave-telegraph (CW), and tone modulated continuous-wave-telegraph (MCW)—assuring reliable and efficient communication with ground stations in all kinds of weather and under all operating conditions. Including dynamotor supply, the equipment, is housed in a metal case measuring 10½" × 10" × 16⅜". Reception is provided in the frequency range of from 2000 to 6500 kc., and a switching arrangement permits rapid selection while in flight of any of three pre-determined frequency channels within this range. Power is supplied by a standard 12-volt storage battery or other direct-current source. Accessibility to the chassis is provided by an ingenious mechanical arrangement by which the entire chassis slides out for inspection purposes.

Airport Boundary Light

• A NEW airport boundary light has been developed by Air-Ways Equipment Corp., Milwaukee, Wisc., which originally was intended for use on the new airports built under the PWA at points without electric current.

Bakelite laminated has been employed in the construction of the marker, some of the boundary lights being yellow Bakelite laminated, while others are green, depending upon their position in the field.



Bakelite airport boundary light

The new marker has a bulb illuminated by a single dry cell. A highly reflective tap develops a maximum illuminating efficiency, and it is reported that the light is visible for a distance of five miles. Another feature is that the boundary light has been designed so that it will break loose from its base if struck by a plane.

Another device developed by the corporation is a wind direction indicator, called the Radi-Cone. This, also, is constructed of Bakelite laminated, and is battery operated.

AC Current Generator

• APPLIANCES ON airplanes which require alternating current for operation can be so supplied by the Autonator unit, a portable source of high voltage—high voltage current. This unit, which is manufactured by Autonator Laboratories, Inc., delivers 110 volts of the desired a.c. current, is driven from the engine's camshaft, and is available in a wide range of power rating (watts) for various types of usage.

The unit in reality is an a.c. alternator, and has no wire-wound armature, commutator, brushes, or collector rings. Its one moving part is on a ball-bearing mounted shaft. Operation is accomplished only when the engine is running, the normal output being 110 volt, 60 cycle a.c. current at 1800 r.p.m. However, the unit may be regulated to furnish steady current at any speed and for any load. It is applicable for such devices as loudspeakers, neon signs, floodlights, beacons, etc. Easy to install, it is furnished complete with a standard double outlet box, switch and mounting brackets.

Dry Method of Fire Extinguishment

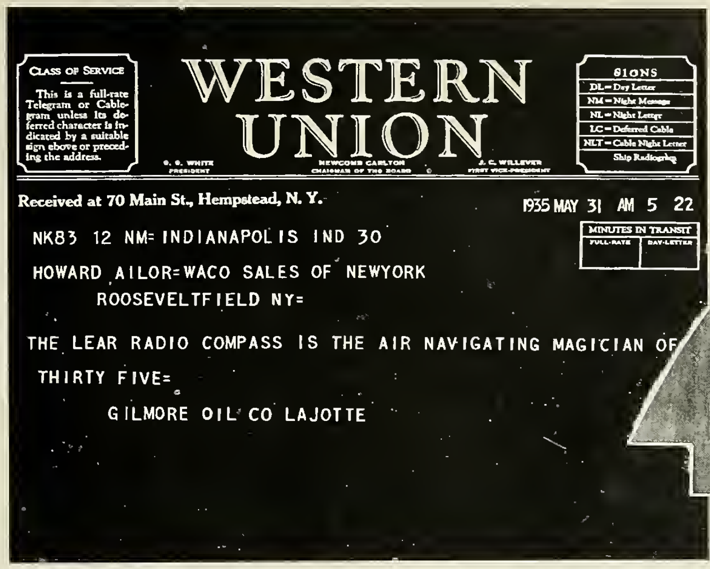
• INDUSTRIAL AND commercial enterprises should be interested in the Garfire Gun, a 3 lb., quickly and easily operated, instantaneous dry extinguisher of incipient fires, manufactured by the Garrison Engineering Corp., Waterbury, Conn.

The Garfire Gun consists of a pump gun and a fire extinguishment compound projector, both made of substantial materials, with exterior shell of brass. Its operation is simple; a turn of pump handle to unlock it and free it for pumping—a freeing of projector nozzle opening by pushing aside the spring clamp which keeps nozzle normally closed—and pumping, which shoots a cloud of dry compound at the flames, killing them at contact, and insulating the burning objects.

This gun has only just been perfected and added to the Garrison line of extinguishing appliances, which up to now consisted only of large, higher-priced professional types, after tests with fires in grease, oil, alcohol, gasoline, ether, acetones, lacquers energized electrical apparatus and other combustibles.

Beacon Equipment

• STRUTHERS DUNN, Inc., relay specialists of Philadelphia, have recently developed equipment for use with high wattage lamps in flashing service. In lighthouse and air beacon service, such lamps may be flashed on and off several times a minute. At the instant of lighting, the inrush current is several times the normal load. This presents a problem since a contactor of sufficient rating to handle the inrush current would be fairly large and these large contactors close with a "hammer" blow. The new panel overcomes these obstacles and permits the current to pass without excessive arching.



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NM = Night Message
NL = Night Letter
LC = Deferred Cable
NLT = Cable Night Letter
Ship Radiogram

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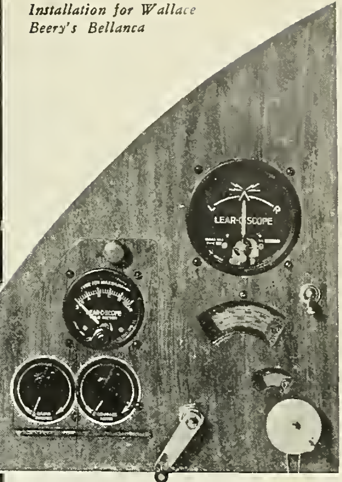
MINUTES IN TRANSIT
FULL-RATE DAY-LETTER

NK83 12 NM=INDIANAPOLIS IND 30
HOWARD AILOR=WACO SALES OF NEWYORK
ROOSEVELTFIELD NY=

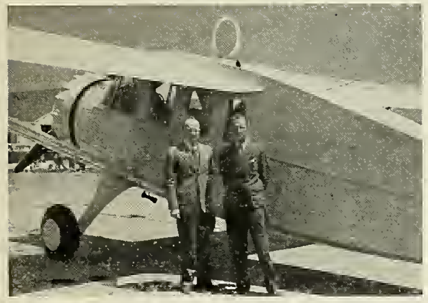
THE LEAR RADIO COMPASS IS THE AIR NAVIGATING MAGICIAN OF THIRTY FIVE=
GILMORE OIL CO LAJOTTE

Right: Special Panel Installation for Wallace Beery's Bellanca



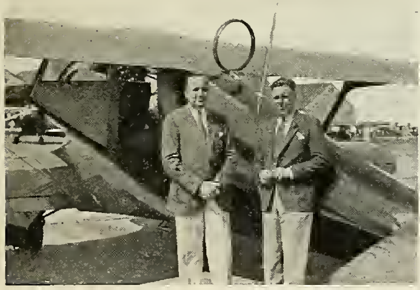
LEAR RADIO COMPASS OWNERS SAY:

". . . One of the most valuable aids in aircraft navigation"
". . . I would not fly a ship without a Lear Compass"
". . . Gives a feeling of the utmost confidence in flying"



Lear Radio Compass in Gilmore Oil Co. Bellanca

THOSE who have had experience with LEAR RADIO COMPASS agree it is one of the most valuable and vitally important aids in aircraft navigation whether for commercial or pleasure flying, or long record trips. « Of course, you know the value of such an instrument, but until you actually experience the assurance of confidence LEAR RADIO COMPASS gives, it is difficult to realize its significance to you. Until you see a LEAR RADIO COMPASS it is difficult for you to realize its simplicity of operation. « A demonstration will prove to you that LEAR RADIO COMPASS is a perfected instrument ready now to install, and to give you dependable performance, reducing your navigation problems to simplest form, even under any weather conditions. « Write, telegraph, telephone and we will be glad to arrange a demonstration at your convenience. « Remember, LEAR RADIO COMPASS is ready for delivery *now*.



Lear Radio Compass in Beechcraft, Bureau of Air Com.

Partial List of Recent Lear Radio Compass Installations:

PLANE:	OWNER:
Lockheed	Amelia Earhart, New York City
Bellanca	U. S. Dept. of Com., Washington
Stinson	H. L. Peterkin, Chicago, Ill.
Bellanca	L. P. Bonfoy, Chairman Ill. Aero. Comm., Quincy, Ill.
Bellanca	Dr. Richard H. Light, New Haven, Conn.
Bellanca	Gilmore Oil Co., California
Waco—Std	Waco Sales Corp., New York City
Vultee	E. L. Cord, California
Northrop	J. Cochrane, Burbank, Calif.
Z	British Air Ministry, London
Boeing	American Airlines, Inc., Chicago, Ill.
Waco—De Luxe	Harry Richman, New York City
Sikorsky—transports	Inter-Island Airways, Hawaii
Z	U. S. Army Signal Corps, Wright Field, Ohio
Bellanca	Wallace Beery, Hollywood, Calif.
Beechcraft	H. L. Farquhar, Mexico City
Ford—4 special transports	Servicio Aereo Colombia, Bogota, Col.
Waco	Leland Heyward, New York City
Beechcraft	Col. Carroll Cone, Washington, D. C.
Waco	John deBlois Wack, Santa Barbara, Calif.
Lockheed Electra	L. Iversen, pres. Mista Machine Co., Pittsburgh, Pa.

Lear Radio Compass in John deBlois Wack's Waco

LEAR DEVELOPMENTS, INC., 125 W. 17th St., New York.

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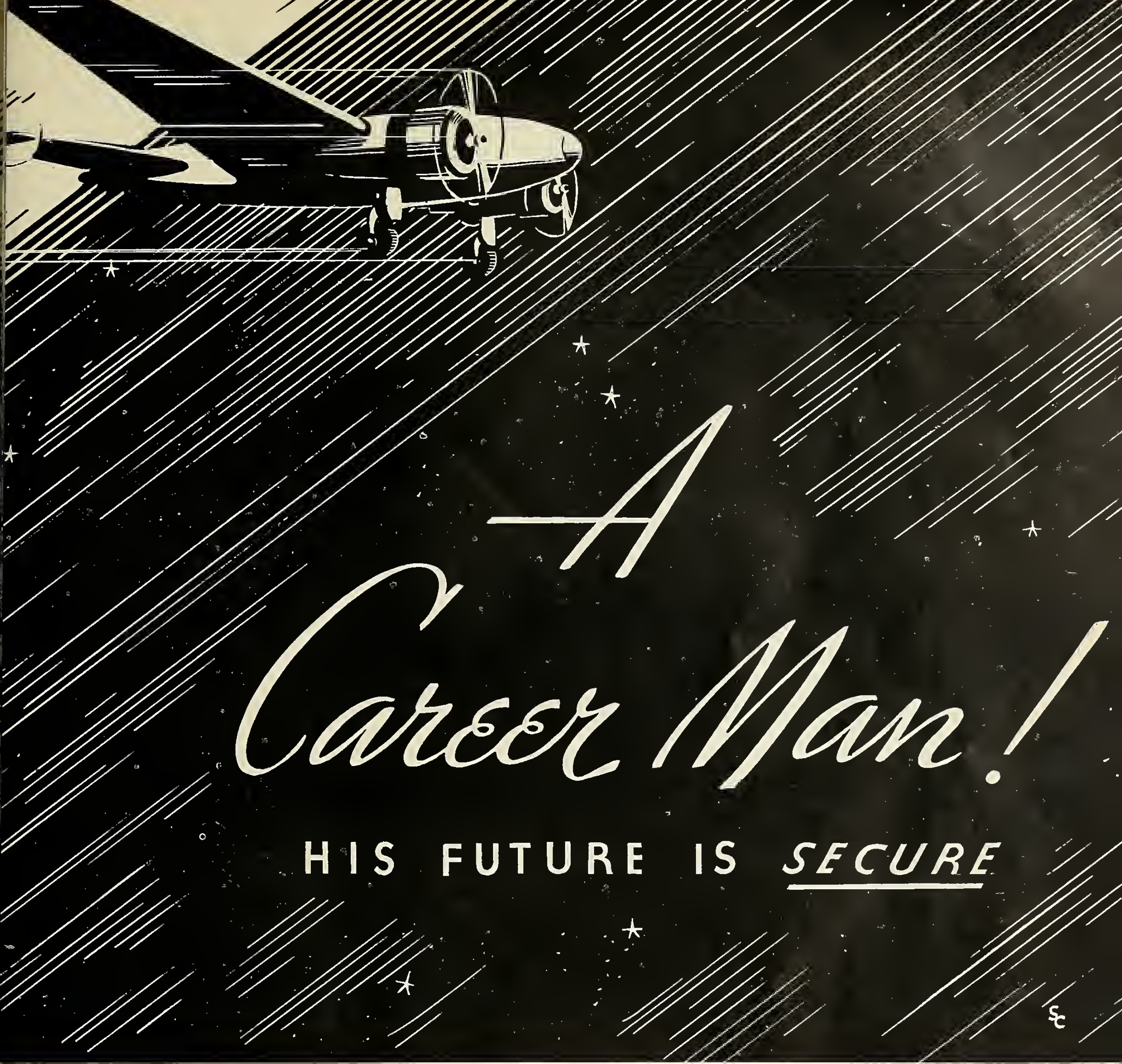

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INDEX TO THE MANUFACTURERS OF FABRICATED PARTS AND AIRCRAFT MATERIALS

ALUMINUM AND ITS ALLOYS
(Raw Materials)
(Also see Castings and Forgings; Miscellaneous Hardware)

Bar Stock
Aero Supply Mfg. Corp.
Aircraft Steel & Supply Co.
Aluminum Co. of America
Sligo Iron Store Co.
Steel Sales Co.

Cable
Aircraft Steel & Supply Co.
Aluminum Co. of America

Extruded Shapes
Aluminum Co. of America
American Magnesium Corp.
Bohn Aluminum & Bronze Corp.
Dow Chemical Co.

Sheet
Aero Supply Mfg. Corp.
Aircraft Steel & Supply Co.
Aluminum Co. of America
Steel Sales Co.
Williams & Co., Inc.

Rivets
Aluminum Co. of America
Metal Goods Corp.

Tubing
Aero Supply Mfg. Corp.
Aircraft Steel & Supply Co.
Aluminum Co. of America
American Brass Company
American Tube Bending Co.
Metal Goods Corporation

Wire
Aero Supply Mfg. Corp.
Aluminum Co. of America

ASBESTOS
Allbestos Corporation
H. Channon Company
Johns-Manville, Inc.
Niagara Asbestos Company

BAFFLES
Dow Chemical Company

CAMSHAFTS
Champion Machine & Forging Co.
Endicott Forging & Mfg. Co.
Indiana Gear Works
Muskegon Specialties Co.
J. W. Nelson Company
Park Drop Forge Company

CASTINGS AND FORGINGS
Advance Pattern & Foundry Co.
Aluminum Co. of America
American Forge Works
American Magnesium Corp.
Atlas Drop Forge Company
Atlas Steel Casting Co.
Bausch Machine & Tool Co.
Bearium Metals Corporation
Bethlehem Steel Co., Inc.
Billings & Spencer
Bohn Aluminum & Brass Corp.
Bunting Brass & Bronze Co.
Camden Forging Company
Canton Drop Forging & Mfg. Co.
Champion Machine & Forge Co.
Dow Chemical Company
Eastern Malleable Iron Co., Inc.
Eclipse Aviation Corp.
Endicott Forging & Mfg. Co.
Farrell-Check Steel Foundry
General Drop Forge Co., Inc.
General Metals Company
A. P. Grimm Foundry
Hamilton Foundry & Machine Co.
Hamilton Steel Company
Industrial Steel Casting Co.
Krodel Foundry
Ladish Drop Forge Co.
Lebanon Steel Foundry
Lumen Bearing Company
McPherson Foundry Co.
Metal & Alloy Specialty Co.
Motor Casting Company
National Forge & Ordnance Co.
Oklahoma Steel Casting Co.
Park Drop Forge Co.
Phillips Bronze Bushing Works
Horace T. Potts
Reliable Pattern Co.
D. J. Ryan Foundry
Standard Brass Mfg. Co.
Steel Improvement & Forge
U. S. Foundries, Inc.
Warman Steel Casting Co.
J. H. Williams & Co.
Wyman-Gordon Company

COLLECTOR RINGS
American Tube Bending Co.
Brewster Aeronautical Corp.
Engle Aircraft Specialties
Pollak Mfg. Co.
Solar Aircraft Co., Ltd.

COPPER AND ITS ALLOYS
(Raw Materials)
(Also see Castings and Forgings; Miscellaneous Hardware)

Bar
Bernitz Mfg. Company
Chase Brass & Copper Co.
Federal-Mogul Corporation
Seaboard Brass & Copper Co.
Service Steel Company

Tubing
American Brass Co.
American Tube Bending Co.
Brass & Copper Sales Co.
Chase Brass & Copper Co.
Ducommon Corporation
C. A. Roberts Company
Seaboard Brass & Copper Co.
Service Steel Company
Wolverine Tube Company

Sheet
Phosphor Bronze Smelting Co.
Titan Metal Mfg. Co.

Wire
John A. Roebling's Sons Co.
Seaboard Brass & Copper Co.

(Fabricated Parts)

Bearings
Bunting Brass & Bronze Co.
Federal Mogul Corp.
McGill Mfg. Co.
Premier Bronze Corp.

CONNECTING RODS
Canton Drop Forging & Mfg. Co.
Champion Machine & Forging Co.
Govro-Nelson Company
Lincoln Machine & Tool Co.

CRANKCASES
Bohn Aluminum & Brass Corp.
Govro-Nelson Company

CRANKSHAFTS
Canton Drop Forging & Mfg. Co.
Champion Machine & Forging Co.
Govro-Nelson Company
Leland Gifford Co.
Muskegon Specialties Co.
J. W. Nelson Company
Ohio Crankshaft Company
Park Drop Forge Company
Union Drawn Steel Co.
Wyman-Gordon Co.

CYLINDER BARRELS
Brown & Sharpe Mfg. Co.
Canton Drop Forging & Mfg. Co.
Cheney & Sons
General Metals Company
Govro-Nelson Company
Wharton & Company

CYLINDER HEADS
Bohn Aluminum & Brass Corp.
Doehler Die Casting Co.
Govro-Nelson Company

EXHAUST STACKS & MANIFOLDS
American Tube Bending Co.
Brewster Aeronautical Corp.
Buhl Stamping Company
National Tube Company

CORK
Armstrong Cork Company
Atlantic-Pacific Mfg. Co.
The Crown Cork & Seal Co.

FABRICS, ETC.

Carpeting
Sidney Blumenthal & Co.
Geo. A. Carpenter
L. C. Chase & Company
Hirst-Rogers Company
Laidlaw Company, Inc.
Mohawk Carpet Mills
Sanford Mills
F. Schumacher & Company
J. H. Thorp & Company
Wm. Wiese & Co., Inc.

Covering
Aircraft Steel & Supply Co.
Suncook Mills
Thurston Cutting Corp.
Wellington Sears Co., Inc.

Drapery
Sidney Blumenthal & Co.
Laidlaw Co., Inc.
F. Schumacher & Company
Wm. Wiese & Co., Inc.

Leather, etc.
American Oak Leather Co.
Anderson Flax Fibre Co., Inc.
Blanchard & Lane
W. D. Byron & Sons Leather Co.
Eagle Ottawa Leather Co.
Pantosote Co., Inc.
Radel Leather Co.
A. G. Seaver
H. D. Taylor
U. S. Rubber Products, Inc.

Tapes
Arbeka Webbing Co.
Suncook Mills
Thurston Cutting Corp.
Wellington Sears Co., Inc.

Upholstery
L. C. Chase & Co.
Cleveland Tanning Co.
Laidlaw Company, Inc.
A. G. Seaver
F. Schumacher & Company
Don Tallmadge Company
Wm. Wiese & Co., Inc.

FELT
American Felt Company
Booth Felt Co., Inc.
Coffeys Felt Company
The Felters Co., Inc.
C. W. House & Sons
Western Felt Works

FIBRE
Continental Diamond Fibre Co.
Ellfeldt Hardware Company
Formica Insulation Company.
National Vulcanized Fibre Co.
Spaulding Fibre Company
White Supply Company
Wilmington Fibre Specialty Co.

FLEXIBLE TUBING
Breeze Corporations, Inc.
Chicago Tubing & Braiding Co.
Eclipse Aviation Corporation
Parker Appliance Company
Roberts Tube Works
Seamlex Corporation
Service Steel Company
Titeflex Metal Hose Co.
U. S. Flexible Tubing Co.
United Wire & Supply Corp.

GASKETS
Detroit Gasket Company
Fitzgerald Mfg. Company
Goetz Gasket & Packing Co.
McCord Radiator & Mfg. Co.
Raybestos-Manhattan, Inc.
Vellumoid Company
Victor Mfg. & Gasket Co.
Western Gasket & Packing Co.

GEARS AND SPROCKETS
Bilgrim Gear & Machine Works
Billings & Spencer Co.
Boston Gear Works
Brown & Sharpe Mfg. Co.
Canton Drop Forging & Mfg. Co.
Champion Machine & Forge Co.
Endicott Forging & Mfg. Co.
Indiana Gear Works
Meisel Press Mfg. Co.

GLASS & TRANSPARENT SHEET
Aircraft Steel & Supply Co.
American Window Glass Co.
DuPont Viscoloid Co., Inc.
Lewis St. Glass Company
Libbey-Owens-Ford Glass Co.
Pittsburgh Plate Glass Co.
Protecto Safety Glass Co.
Saftee Glass Company

GLUE & CEMENT
B. F. Goodrich Company
Dolphin Paint & Varnish Co.
Westinghouse Elec. & Mfg. Co.

HARDENED AND GROUND PARTS
Coast Centerless Grinding Co.
Cook Heat Treating Co.
Govro-Nelson Company
Hartford Machine Screw Co.

INSULATED WIRE & CABLE
American Steel & Wire Co.
General Cable Corp.
Packard Electric Corp.
John A. Roebling's Sons Co.
U. S. Rubber Products, Inc.

INSULATING & SOUNDPROOFING
Anderson Flax Fibre Co., Inc.
Booth Felt Co., Inc.
Chicago Curled Hair Co.
Formica Insulation Co.
Johns-Manville, Inc.

Ladish Drop Forge Co.

Removing a forged part from the press

Wellington-Sears Co.

Production of yarns used in airplane fabrics

The following pages contain a directory of the sources of supply of fabricated parts and raw materials. The listings are as complete as could be made with the information available. The accompanying index indicates the manufacturers of the items listed. Complete data relating to the companies is given in the directory section (pages 66 to 94) where manufacturers are listed in alphabetical order.

Rubatex Products, Inc.
Saftee Glass Company
Saylor Elec. & Mfg. Co.
Seaman Paper Company
Spaulding Fibre Company
Wilmington Fibre Spec. Co.
Wood Conversion Company

LINK PINS

Burgess Norton Mfg. Company
Greist Manufacturing Co.
Marquette Metal Products Co.
Wichita Wire Products Co.

MISCELLANEOUS HARDWARE

Aero Supply Mfg. Corp.
Air Associates, Inc.
Aluminum Co. of America
Aluminum Industries, Inc.
Chicago Screw Co.
Dardelet Threadlock Corp.
Elastic Stop Nut Corp.
Emsco Asbestos Company
Ex-Cell-O Aircraft & Tool Corp.
Hartford Machine Screw Co.
Marquette Metal Products Co.
Milford Rivet & Machine Co.
Palnut Company
Parker-Kalon Corporation
Penn Rivet Company
Rhode Island Tool Co.
John A. Roebling's Sons Co.
Joseph T. Ryerson & Son, Inc.
Standard Screw Company
Waterbury Button Company

MOLYBDENUM

Climax Molybdenum Corp.

PAINT, DOPE, VARNISH, LACQUER, ENAMEL

(Initials in brackets indicate products)

Acme White Lead & Color Wks. (E)
Berry Bros. (D-P-E-L-V)
Brooklyn Varnish Mfg. Co. (P)
Cook Paint & Varnish Co. (P-D)
E. I. duPont de Nemours & Co., Inc. (P-V-L-D)
Egyptian Lacquer Co. (P-E)
W. P. Fuller & Co. (D-E-L)
Glidden Co. (P-D-V-L-E)
Hilo Varnish Corp. (P-V-L-E)
Jones-Dabney Co., Inc. (D-V-L-E)
Kay & Ess Co. (D-L-E)
Lowe Bros. Co. (P-V-E)
Merrimac Chemical Co. (D-L)
Murphy Varnish Co. (V-L-E)
No. Bergen Paint & Varnish Co. (P)
Perry-Austin Mfg. Co. (P-D-L)
Pittsburgh Plate Glass Co. (P-D-V-L)
Pratt & Lambert, Inc. (P-D-V-L-E)
Randolph Fnshg. Prod. (P-D-L)
Rinshed Mason Co. (L)
Seibert Varnish Co. (P-E)
Sewall Paint & Varnish Co. (P)
Sherwin-Williams (P-D-V-L-E)
Thresher Varnish Co. (V)
Titanine, Inc. (D-E-V-L)
Valentine & Co. (P-V)

PANELING

Haskelite Mfg. Corporation

PISTONS

Aluminum Industries, Inc.
Bohn Aluminum & Brass Corp.
Ohio Piston Company
Sealed Power Corp.

PISTON PINS

Aluminum Industries, Inc.
Burgess Norton Mfg. Co.
Ex-Cell-O Aircraft & Tool Corp.
Indiana Gear Works
Marquette Metal Products Co.
McQuay-Norris Mfg. Co.
Ohio Piston Company
Sealed Power Corporation
Thompson Products, Inc.

PISTON RINGS

Amer. Hammered Piston Ring Co.
Arrow Head Steel Products Co.
Perfect Circle Co.
Sealed Power Corp.
Simplex Piston Ring Sls. Co.
U. S. Hammered Piston Ring Co.
Wilkening Mfg. Company

PULLEYS

Formica Insulation Company
Molded Insulation Company
Westinghouse Elec. & Mfg. Co.

RUBBER UTILITIES

B. F. Goodrich Company
Continental Rubber Works
Firestone Tire & Rubber Co.
General Tire & Rubber Co.
Goodall Rubber Company
Goodyear Tire & Rubber Co.
Lord Manufacturing Company
Ohio Rubber Company
Philpott Rubber Company
Raybestos-Manhattan, Inc.
Rubatex Products, Inc.
Rubbercraft Corp. of Cal. Ltd.
United States Rubber Prod., Inc.

STAMPINGS

Aluminum Co. of America
V. A. Boker & Sons
Peco Manufacturing Company
Otto Konigslow Mfg. Co.
Raymond Mfg. Company
Whitehead Stamping Company
Worcester Stamped Metal Co.

SHEET PACKING

Vellumoid Company
Victor Mfg. & Gasket Co.

SHIELDING

Air Associates, Inc.
Breeze Corporations, Inc.
Engle Aircraft Specialties
General Cable Corp.
Scintilla Magneto Co., Inc.
Seamlex Corp.

SPRINGS

Advance Spring & Wire Co.
Airplane Spring Company
American Steel & Wire Co.
Atlantic Spring Mfg. Co.
California Spring Company
Cary Spring Works, Inc.
Chicago Coil Spring Co.
Cleveland Wire Spring Co.
Charles Fischer Spring Co.
W. D. Gibson Company
George A. Hebb Company
W. B. Jones Spring Co.
Kline Spring Company
Lee Spring Company
Los Angeles Spring Co.
Miller & Van Winkle
Plomb Tool Company
Railway Steel Spring Co.
Raymond Mfg. Company
Thomas Wire & Spring Co.
Wichita Wire Products Co.
Yost Superior Company
L. A. Young Spring Co.

STEEL AND ITS ALLOYS

(Raw Materials)

(Also see Castings and Forgings; Miscellaneous Hardware)

Bar Stock

Aero Supply Mfg. Corp.
American Steel & Wire Co.
Bethlehem Steel Co., Inc.
Craine-Schrage Company
Crucible Steel Company
Dickerson Steel Company
Henry Disston & Sons, Inc.
Firth-Sterling Steel Co.
Peter A. Frasse & Co.
Halcomb Steel Company
Hamilton Steel Company
Joseph T. Ryerson & Son, Inc.
Scully Steel Products Co.
Sligo Iron Store Co.
Timken Steel & Tube Co.
U. S. Steel Corporation

Cable

Aircraft Steel & Supply Co.
American Steel & Wire Co.
Barbour-Stockwell Co.
Belden Manufacturing Co.
Hazard Wire Rope Co.
John A. Roebling's Sons Co.

Flat Sheet

Aero Supply Mfg. Corp.
Aircraft Steel & Supply Co.
Allegheny Steel Company
American Sheet & Tin Plate Co.
Carpenter Steel Company
Central Steel & Wire Co.
Crucible Steel Company
Peter A. Frasse & Company
Halcomb Steel Company
Hamilton Steel Company
W. Leechburg Steel Company
Republic Steel Corporation
Joseph T. Ryerson & Son, Inc.
Sligo Iron Store Company
U. S. Steel Corporation

Tubing

Aircraft Steel & Supply Co.
American Tube Bending Co.
Central Steel & Wire Co.
Peter A. Frasse & Co.
Hamilton Steel Co.
Michigan Seamless Tube Co.
National Tube Co.
Ohio Seamless Tube Co.
Republic Steel Corp.
Joseph T. Ryerson & Son, Inc.
Summerill Tubing Company

Wire

American Steel & Wire Co.
Central Steel & Wire Co.
Hazard Wire Rope Co.
John A. Roebling's Sons Co.
Stewart Hartshorn Co.
Tank Brothers

(Fabricated Parts)

Bearings

Bantam Ball Bearing Co.
Bound Brook Oilless Bearing Co.
Fafnir Bearing Company
Federal Bearings Co., Inc.
Fischer Ball Bearing Co.
Marlin-Rockwell Corp.
New Departure Mfg. Co.
Norma-Hoffmann Bearings Corp.
SKF Industries, Inc.
Timken Roller Bearing Co.
Torrington Company

Bushings

Amer. Non Gran Bronze Corp.
Bunting Brass & Bronze Co.
Danly Machine Specialties, Inc.
Horace T. Potts
U. S. Graphite Company

STREAMLININGS

Engle Aircraft Specialties Co.
Gem City Sheet Metal Company
Theo. Hergert, Incorporated
Hill Aircraft Streamliners Co.

TANKS

Aluminum Co. of America
Andrews Steel Co.
Brewster Aeronautical Corp.
Ducommon Corp.
Fleetwings, Inc.
Hill Aircraft Streamliners Co.

TIE RODS

Breeze Corporations, Inc.
Macwhyte Company
Stewart Hartshorn, Inc.

VALVES

Aluminum Industries, Inc.
Imperial Brass Mfg. Co.
Jadson Motor Products Co.
Parker Appliance Co.
Rich Tool Company
Thompson Products, Inc.
United Aircraft Products, Inc.
Wilcox Rich Corporation

VALVE GUIDES

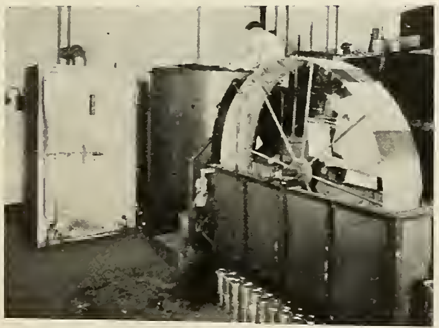
Amer. Non Gran Bronze Corp.
Doehler Die Casting Co.
Ex-Cell-O Aircraft & Tool Co.
Indiana Gear Works
Shenango-Penn Molding Co.
Thompson Products, Inc.

VALVE SEATS & INSERTS

American Brass Co.
Bohn Aluminum & Bronze Corp.
Burd High Compression Ring Co.
Govro-Nelson Co.
Lumen Bearing Co.
Steel Sales Co.
Thompson Products, Inc.
Wilcox-Rich Corp.

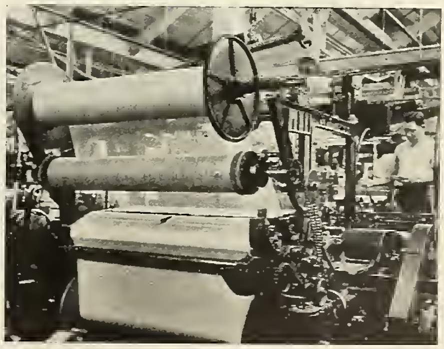
WOOD AND PLYWOOD

Aircraft Steel & Supply Co.
Algoma Plywood & Veneer Co.
Atlantic Lumber Company
E. K. Bishop Lumber Co.
California Panel & Veneer Co.
Carrom Company
Central Panel & Supply Co.
Fessenden Hall
Cross, Austin, Island Lumber Co.
Haskelite Mfg. Corporation
Indiana Veneer & Panel Co.
W. Megin Lumber Company
F. Paxton Lumber Co.
Pike-Dial Lumber Company
Posey Mfg. Company
Roddis Lumber & Veneer Co.
Sitka Spruce Lumber Co., Ltd.
E. J. Stanton & Sons
U. S. Plywood Company
Woodcraft Corporation
Yoho & Hooker



Pittsburgh Plate Glass Co.

Equipment for accelerating tests of paints



L. C. Chase & Co.

Weaving modern cabin upholstery materials

Manufacturers of Fabricated Parts and Aircraft Materials (continued)

A

ACME WHITE LEAD & COLOR WORKS,
Detroit, Mich.

Aeronautical products: Enamels.

ADVANCE PATTERN & FOUNDRY Co.,
2734 W. 36th Place, Chicago, Ill.

Aeronautical personnel: J. E. Campbell.

Aeronautical products: Castings (aluminum).

ADVANCE SPRING & WIRE CO.,
1749-61 Carroll Ave., Chicago, Ill.

Aeronautical products: Springs.

AERO SUPPLY MFG., CORP., Corry, Pa.

Aeronautical personnel: Frank N. Ames, president; S. J. Irvine, general manager.

Aeronautical products: Hardware. Steel (sheet; strip; chrome molybdenum bar). Aluminum (bar; shapes). Tubing. Aluminum alloy (sheet). Wire. Fuel system units. Assemblies. Fittings. Controls.

AIR ASSOCIATES, INC.
Roosevelt Field, Long Island, N. Y.

Branch offices: 5300 W. 63 St., Chicago, Ill.; 1200 Airway, Glendale, Calif.

Aeronautical personnel: F. Leroy Hill, president and general manager; H. I. Crow, secretary, treasurer, general sales manager; Ray Acre, Chicago manager; Fred E. Rowe, assistant Chicago manager; Ted Lynn, Western Branch manager; Sam Breder, Western Division sales manager.

Aeronautical products: Radio shielding. Wind-driven electrical generators. Wind cones and wind direction finders. Rotating airport beacon lights. Helmets, goggles, aviation clothing. Instruments. Storage battery boxes or containers. Booster coils. Switches. Cabin ventilator. Safety belts. Tail wheels. Aircraft hardware.

THE AIRCRAFT STEEL & SUPPLY CO.,
528 W. Douglas, Wichita, Kans.

Aeronautical personnel: O. W. Wortman, president; J. S. Wright, pilot and representative.

Aeronautical products: Steel tubing. Steel (strip; sheet). Wire (round edge flat). Aluminum sheet, rod and tube. Control cable. Fabric. Plywood. Pyralin. Hardware. Finishing materials.

AIRPLANE SPRING CO.,
30 Main St., Brooklyn, N. Y.

Aeronautical products: Springs.

ALGOMA PLYWOOD & VENEER CO.,
Algoma, Wisc.

Aeronautical personnel: M. W. Perry, president; W. E. Perry, vice-president and general manager; G. H. Bechtold, secretary.

Aeronautical products: Plywood.

ALLISON ENGINEERING CO.,
Indianapolis, Indiana

Aeronautical personnel: N. H. Gilman, general manager.

Aeronautical products: Bearings.

ALLEGHENY STEEL CO.,
Brackenridge, Pennsylvania

Aeronautical personnel: W. J. McArdle, general sales manager.

Aeronautical products: Steel (stainless sheet).

ALLBESTOS CORP., Germantown, Pa.

Aeronautical products: Asbestos.

ALUMINUM CO. OF AMERICA, INC.,
Pittsburgh, Pa.

Branch offices: 90 State St., Albany, N. Y.; Rhodes-Haverty Bldg., Atlanta, Ga.; 20 Providence St., Park Square, Boston, Mass.; 1880 Elmwood Ave., Buffalo, N. Y.; 520 N. Michigan Ave., Chicago, Ill.; Times Star Bldg., Cincinnati, Ohio; 2210 Harvard Ave., Cleveland, Ohio; 3311 Dunn Rd., Detroit, Mich.; Boston Post Rd., Fairfield, Conn.; Capitol Bldg., 410 Asylum St., Hartford, Conn.; Merchants Bank Bldg., Indianapolis, Ind.; Power & Light Bldg., Kansas City, Mo.; 1031 S. Broadway, Los Angeles, Calif.; 735 N. Water St., Milwaukee, Wis.; Northwestern Bank Bldg., Minneapolis, Minn.; Academy Bldg., Newark, N. J.; American Bank Bldg., New Orleans, La.; 230 Park Ave., New York, N. Y.; Fidelity-Philadelphia Trust Bldg., Philadelphia, Pa.; Rialto Bldg., San Francisco, Calif.; Boatmen's Bank Bldg., St. Louis, Mo.; White Building, Seattle, Wash.; Ohio Bank Bldg., Toledo, Ohio; Southern Bldg., Washington, D. C.

Aeronautical products: Aluminum and aluminum alloys (sheets, coiled and flat; plate, rod, wire and bar; foil; extruded shapes; tubing, round, square, rectangular, special shapes; electrical conductor; fittings; screw machine products, rivets; impact extrusion products; alclad sheet, coiled and flat; aircraft castings; aircraft forgings). *Alcoa Albron* (powder and paste for aluminum paint). Fuel tanks. Ingot.

ALUMINUM INDUSTRIES, INCORPORATED
2416 Beekman St., Cincinnati, O.

Branch engineering and sales office: Fisher Bldg., Detroit, Mich.

Service branches: 431 Peachtree St., Atlanta, Ga.; 1923 S. Wabash Ave., Chicago, Ill.; 2033 Commerce St., Dallas, Tex.; 477 Selden Ave., Detroit, Mich.; 1617 McGee St., Kansas City, Mo.; 1146 So. Olive St., Los Angeles, Calif.; 160 W. 62 St., New York, N. Y.; 316 N. W. 12 Ave., Portland, Ore.; Cooper & 33 Ave. N., St. Cloud, Minn.; 731 Polk St., San Francisco, Calif.; 83 Rue Lamoriniere, Antwerp, Belgium. Permite Products of Canada, Ltd., 43 Britain St., Toronto, Ontario, Can.

Aeronautical personnel: H. J. Hatter, vice-president and general manager; J. P. Andrae, vice-president in charge of aeronautical sales; M. A. Beckmann, chief engineer; B. J. Plumley, district sales manager (Detroit).

Aeronautical products: Pistons (*Permite* aluminum alloy). Valves (*Permite* dia-chrome and steel). *Permite* piston pins. *Permite* torque pins. *Permite* aluminum hinge bearings.

THE AMERICAN BRASS CO. (American Metal Hose Branch)
P. O. Box 791, Waterbury, Conn.

Branch offices: 25 Broadway, New York, N. Y.; 1326 W. Washington Blvd., Chicago, Ill.

Aeronautical personnel: C. S. Hungerford, vice-president; J. E. Locke, sales manager; W. B. Pickard, superintendent; J. O. Maxwell, chief engineer; E. T. Candee, supervisor; W. S. Edwards, purchasing agent; C. E. Woodward, sales promotion manager.

Aeronautical products: Flexible aluminum conduit (Navy spec.). Radio shielding tubing. Flexible exhaust tubing. Flexible aluminum air ducts. Seamless flexible metal tubing for fuel and oil lines. Flexible metal steam and oil hose for airport use. Valve seats. Copper. Copper alloys.

AMERICAN FELT COMPANY
315 Fourth Ave., New York, N. Y.

Factories: City Mills, Mass.; Franklin, Mass.; Glenville, Conn,; Rahway, N. J.; Newburgh, N. Y.

Branch offices: 213 Congress St., Boston, Mass.; 325 So. Market St., Chicago, Ill.; 2751 E. Jefferson Ave., Detroit, Mich.; Ninth Vincent Bldg., Cleveland, Ohio; Drexel Bldg., Philadelphia, Pa.; 451 E. Third St., Los Angeles, Calif.; 309 Minna St., San Francisco, Calif.; 2737 First Ave. So., Seattle, Wash.; 305 N. W. 12 St., Portland, Ore.; 1629 Locust St., St. Louis, Mo.

Aeronautical personnel: J. T. Lawless, president; G. W. Gay treasurer; J. F. Marshall, general sales manager.

Aeronautical products: Felt (soundproofing and vibration deadening).

AMERICAN FORGE WORKS,
1428 13th Street, Denver, Colo.

Aeronautical products: Forgings (steel).

AMERICAN HAMMERED PISTON RING CO.,
Bush & Hamburg St., Baltimore, Md.

Aeronautical products: Piston rings.

THE AMERICAN OAK LEATHER CO.,
Kenner & Dalton Ave., Cincinnati, O.

Factories: Cincinnati, O.; Louisville, Ky.

Branch offices: 354 Congress St., Boston, Mass.; 350 W. Ontario St., Chicago, Ill.; 1608 Locust St., St. Louis, Mo.

Aeronautical personnel: W. H. Mooney, president; E. L. Neilson, vice-president; J. B. Mantle, secretary-treasurer; A. C. Utrecht, production manager.

Aeronautical products: Leather (cabin and cockpit upholstery).

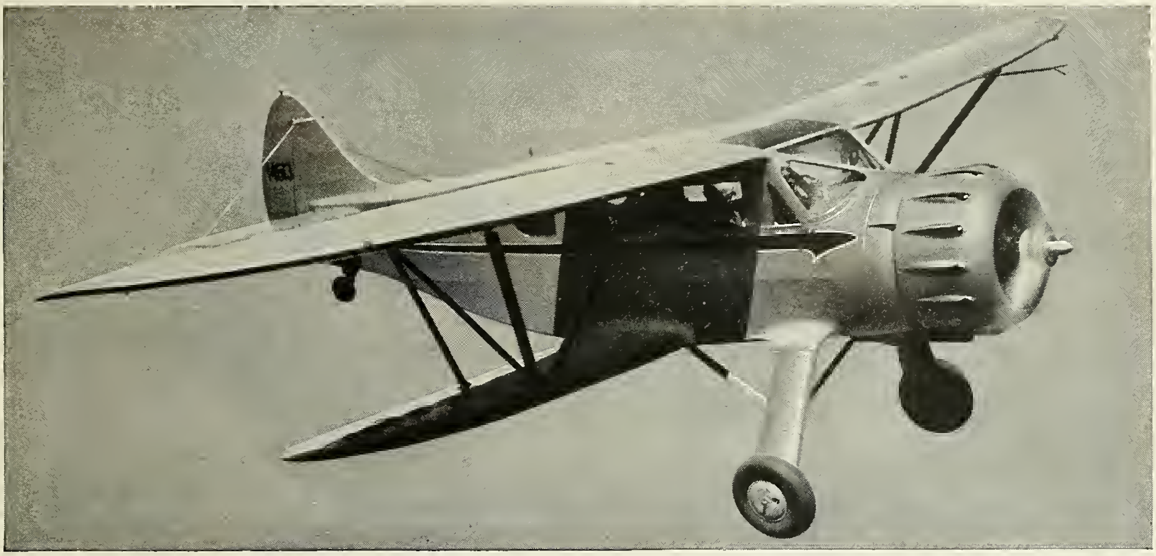
AMERICAN SHEET & TIN PLATE CO.,
Pittsburgh, Pennsylvania

Aeronautical personnel: H. V. Jamison.

Aeronautical products: Stainless parts (steel).

(*Continued on following pages*)

Now Waco offers new Luxury Air Cruiser



SPECIFICATIONS FOR NEW CUSTOM CABIN WACO WRITTEN BY AIR SPORTSMEN

Before putting a line on paper for this custom cabin WACO, we asked many prominent sportsmen pilots to give us their suggestions for their *ideal* cabin ship. And we've given you *everything* you asked for!

You wanted greater speed! We've given you that. A Continental will develop top speed of 150 MPH—a Jacobs, 160 MPH—a Wright, 168 MPH. Cruising speeds at 1900 RPM are 135, 140 and 148 MPH respectively. These speeds have been consistently maintained in an exhaustive series of tests at Troy, Ohio, at approximately 1,000 feet above sea level. New lines with improved fairing at all points have given greater speed, using only four-fifths of available horsepower, resulting in less gas consumption, lower operating costs and longer life.

You wanted greater comfort! We've given you that. Front seats are full 17″ wide with an increased aisle space between them. Rear seats are 3″ wider than previous models. There is 6″ more floor space between front and rear seats. Then, too, we've increased the size of the luggage compartment. Outside and inside doors make luggage "get-at-able" during flight, even without moving the rear seat. Three oversize gladstone bags and four full sets of golf clubs can be easily accommodated.

You wanted greater safety! And we've given you that, too. Electrically operated wing flaps enable pilots to land in restricted spaces not otherwise possible. Balancing tabs, operated inside the cabin, bring the ship into balance immediately when wing tanks are used separately.

From propeller to rudder this new custom cabin job upholds WACO's highest traditions for safety, dependability, and luxurious comfort. See your WACO dealer for a demonstration without delay!

THE WACO F-5 AND D

These two popular WACO models are again offered this year to flyers who want high performance open planes for sport, training or business.

The F-5 is a three-place ship ideally suited for training or sport. It is an outstanding airplane in its field and is noted for its flying ease, stability and performance.

The Model D is a super-sport ship, beautiful in design and unmatched in performance. Never before has a ship in the sports classification been so complete. Nothing needs to be added for day or night flying. And extraordinary maneuverability and high speed make the WACO Model D one of the greatest airplanes ever built.

THE WACO AIRCRAFT COMPANY, TROY, OHIO

WACO
AIRPLANES

"Ask Any Pilot"

WACO LEADS IN AIRCRAFT REGISTRATION

Manufacturers of Fabricated Parts and Aircraft Materials (continued)

AMERICAN MAGNESIUM CORPORATION,
2210 Harvard Avenue, Cleveland, Ohio

Branch offices: See Aluminum Corporation of America (sales organization).

Aeronautical personnel: W. G. Harney, sales manager.

Aeronautical products: Castings (magnesium alloys said and die). Extruded shapes and rod. Rolled sheet magnesium alloy.

AMERICAN NON GRAN BRONZE CORP.,
Berwyn, Pennsylvania

Aeronautical personnel: P. E. Guckes.

Aeronautical products: Valve guides. Bearings. Tappet guides. Bushings (steel).

AMERICAN STEEL AND WIRE COMPANY
208 S. La Salle St., Chicago, Ill.

Branch offices: 101 Marietta St., Atlanta, Ga.; First National Bank Bldg., Baltimore, Md.; Brown-Marx Bldg., Birmingham, Ala.; Statler Bldg., Boston, Mass.; 670 Ellicott St., Buffalo, N. Y.; Union Trust Bldg., Cincinnati, O.; Rockefeller Bldg., Cleveland, O.; Praetorian Bldg., Dallas, Tex.; First National Bank Bldg., Denver, Colo.; Buhl Bldg., Detroit, Mich.; 417 Grand Ave., Kansas City, Mo.; Sterick Bldg., Memphis, Tenn.; Bankers Bldg., Milwaukee, Wisc.; Merchants National Bank Bldg., St. Paul, Minn.; 30 Church St., New York, N. Y.; Hales Bldg., Oklahoma City, Okla.; Widener Bldg., Philadelphia, Pa.; Frick Bldg., Pittsburgh, Pa.; Walker Bank Bldg., Salt Lake City, Utah; 506 Olive St., St. Louis, Mo.; Miners Bank Bldg., Wilkes-Barre, Pa., Pa.; 94 Grove St., Worcester, Mass. Columbia Steel Co. (Pacific Coast Distributors) Russ Bldg., San Francisco, Calif.; 2087 E. Slauson Ave., Los Angeles, Calif.; 777 Nicolai St., Portland Ore.; 4th Ave., S., & Connecticut St., Seattle, Wash.; Castle & Cook Bldg., Honolulu, H. I.

Aeronautical personnel: (Cleveland office) C. F. Blackmer, president; C. F. Hood, vice-president; A. F. Allen, secretary-treasurer; F. E. Chesney, purchasing agent. (Chicago office) D. A. Merriman vice-president and general manager of sales; W. A. Cordes, advertising manager.

Aeronautical products; Steel (stainless 18-8 *USS;* cold rolled strip; cold finished bar). Ignition cable (shielded and unshielded high tension; shielded primary; twin-conductor wing and tail light single- and twin-conductor armored lighting). Wire and cable (tinned or galvanized strand; 18-8 *Stainless Steel;* cord, cotton center). Springs. Welding wire. Spring wire.

AMERICAN TUBE BENDING CO., INC.,
5 Lawrence St., New Haven, Conn.

Aeronautical personnel: R. H. Wulf, president; N. C. Wellman, vice-president; E. L. Wulf, secretary; J. L. Umsteadt, superintendent.

Aeronautical products: Steel, brass, copper, aluminum and aluminum alloy tubular parts (intake pipes, oil lines, ignition cable tubes, exhaust collectors, exhaust stacks).

AMERICAN WINDOW GLASS COMPANY,
Farmer Bank Bldg., Pittsburgh, Pa.

Aeronautical personnel: E. D. Mason.

Aeronautical products: Windshield and enclosure material. Cabin glass.

ANDERSON FLAX FIBER COMPANY, INC.,
39 Niagara St., Buffalo, New York

Aeronautical personnel: H. G. Anderson, president; A. M. Anderson, vice-president; L. E. Jordan, secretary.

Aeronautical products: (Distributors) Leather. Insulating and soundproofing (curled hair; Kapoc; fibre; cotton batting and felt).

ANDREWS STEEL CO., Newport, Ky.

Aeronautical products: Tanks (steel).

ARMSTRONG CORK CO., Lancaster, Pa.

Factories: Lancaster, Pa.; Pittsburgh, Pa.; Beaver Falls, Pa.; Camden, N. J.

Aeronautical personnel: S. E. Conybeare, general manager; F. E. Stevens, assistant general manager.

Aeronautical products: Cork (sheet; gaskets; catwalk facing; flooring and wall finish).

ARROW HEAD STEEL PRODUCTS CO.,
1101 Stinson Blvd., Minneapolis, Minn.

Aeronautical personnel: F. C. Bahr, president; W. C. Wilson, advertising manager.

Aeronautical products: Piston rings.

ATLANTIC LUMBER CO., Boston, Mass.

Aeronautical products: Maple.

ATLANTIC-PACIFIC MANUFACTURING CO.,
124 Atlantic Ave., Brooklyn, N. Y.

Aeronautical products: Cork.

ATLANTIC SPRING MFG.,
Lehigh Ave. & Motter St., Philadelphia, Pa.

Aeronautical products: Springs.

ATLAS DROP FORGE CO., Lansing, Mich.

Aeronautical products: Forgings (steel).

ATLAS STEEL CASTING CO.,
Black Rock Station, Buffalo, N. Y.

Aeronautical products: Castings (steel).

ARBEKA WEBBING CO., Pawtucket, R. I.

Aeronautical personnel: John Howe, manager.

Aeronautical products: Tapes (fabric).

B

BANTAM BALL BEARING CO.,
South Bend, Indiana

Aeronautical personnel: H. D. Allee, manager of automotive division.

Aeronautical products: Bearings (needle).

BARBOUR-STOCKWELL COMPANY,
205 Broadway, Cambridge, Mass.

Aeronautical personnel: E. D. Ryer.

Aeronautical products: Cable.

BAUSH MACHINE & TOOL CO.,
156 Wasen, Springfield, Mass.

Aeronautical products: Forgings (aluminum).

BEARIUM METALS CORPORATION,
258 State Street, Rochester, N. Y.

Aeronautical personnel: E. P. Langworthy, president and general manager; Dr. H. M. Rees, vice-president.

Aeronautical products: Bronze and copper alloy castings.

BELDEN MANUFACTURING CO.,
4647 W. Van Buren, Chicago, Ill.

Aeronautical personnel: H. W. Clough.

Aeronautical products: Cable (steel).

BERNITZ MANUFACTURING CO.,
1400 Oak St., Kansas City, Mo.

Aeronautical products: Brass hardware.

BERRY BROS., 211 Leib St., Detroit, Mich.

Factories: Detroit, Mich.; Walkerville, Ont., Canada.

Branch offices: 129-26 St., Brooklyn, N. Y.; 21 Power House St., Boston, Mass.; Delaware Ave. & Tasker St., Philadelphia Pa.; 300 West Austin Ave., Chicago, Ill.; 130 West Court St., Cincinnati, O.; 6513 Page Ave., St. Louis, Mo.

Aeronautical personnel: T. J. Campbell, president; T. B. Colby, vice-president and aviation manager; H. L. Acker, chemist; W. F. Bartz, production manager.

Aeronautical products: *Berryloid* Dope (clear; pigmented). Thinner. Paint. Enamel. Lacquer. Varnish. Primer.

BETHLEHEM STEEL CO., INC., Bethlehem, Pa.

Branch offices: In all principal cities.

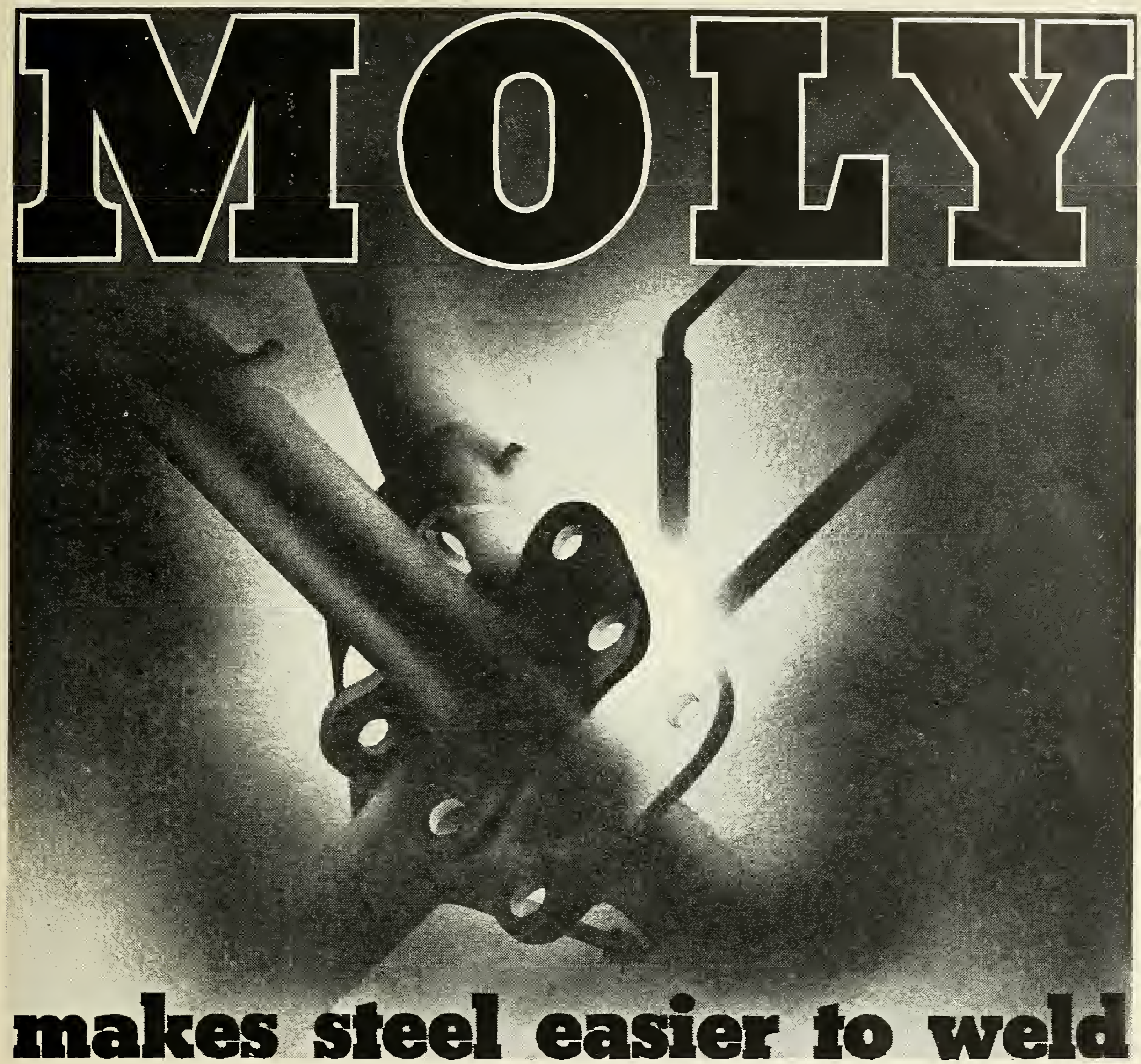
Aeronautical personnel: H. G. Walton, general manager of sales.

Aeronautical products: Forgings (drop and hammer for crankshafts; connecting rods; camshafts; rocker arms; gears). Bar stock (normal carburizing; alloy; special carbon).

BILGRAM GEAR & MACHINE WORKS,
1217 Spring Garden St., Philadelphia, Pa.

Aeronautical products: Gears.

(Continued on following pages)



Molybdenum is practically the only alloy used in steel which does not interfere with welding. In airplane construction, where strength and light weight are of paramount importance, welding and "Moly" steels have gone hand in hand. The welds have proved tougher and stronger, with less embrittlement of surrounding areas. Indeed, Moly is often used in the coatings of welding rods to improve the quality of the weld.

Because of the air-hardening properties imparted by Moly, welded chrome Moly tubes show the same strength in the weld as in the unwelded sections. The same property obviates one troublesome operation—the welded assemblies do not require annealing. Quenching a complete assembly is always a nuisance, as it may result in breakage during handling.

Moly always improves steel. Increases tensile strength, creep strength and resistance to wear. Gives a superior steel at a "competitive" initial price and a lower cost for the finished product. The modern Climax laboratories in Detroit and the Climax metallurgists are prepared to prove these points. Write for details about our free engineering and experimental services and a helpful book: "Molybdenum." Climax Molybdenum Co., 500 Fifth Ave., New York City. (In Canada: Railway & Power Engineering Corp., Ltd.)

CLIMAX Mo-lyb-den-um

Manufacturers of Fabricated Parts and Aircraft Materials (continued)

BILLINGS & SPENCER COMPANY,
1 Laurel, Hartford, Conn.

Aeronautical personnel: W. Roy Moore, vice-president and general manager; H. H. Cleveland, general sales manager.

Aeronautical products: Gears. Forgings (steel).

E. K. BISHOP LUMBER COMPANY,
Aberdeen, Washington

Aeronautical products: Spruce.

BLANCHARD & LANE, Newark, N. J.

Aeronautical personnel: S. B. Gay.

Aeronautical products: Upholstery (leather).

SIDNEY BLUMENTHAL & CO.,
1 Park Ave., New York, N. Y.

Aeronautical personnel: G. B. Matthews.

Aeronautical products: Drapery. Carpets.

BOHN ALUMINUM & BRASS CORP.,
Lafayette Bldg., Detroit, Mich.

Aeronautical personnel: Charles E. Bohn.

Aeronautical products: Cylinder heads. Crankcases. Pistons. Castings (aluminum). Extruded Shapes (aluminum). Valve seats.

V. A. BOKER & SONS,
1920 Washington Av. S., Minneapolis, Minn.

Aeronautical personnel: V. A. Boker, president.

Aeronautical products: Stampings (parts fabricated to specifications for aircraft and radios).

BOOTH FELT CO., INC., Brooklyn, N. Y.

Aeronautical personnel: Edwin W. Booth.

Aeronautical products: Felt. Insulation material.

BOSTON GEAR WORKS, Quincy, Mass.

Aeronautical personnel: K. E. Johnston.

Aeronautical products: Gears.

BOUND BROOK OILLESS BEARING CO.,
Bound Brook, New Jersey

Aeronautical products: Bearings.

BRASS & COPPER SALES,
2817 Laclede Ave., St. Louis, Mo.

Aeronautical products: Fuel line tubing.

BREEZE CORPORATIONS, INCORPORATED,
24 South Sixth St., Newark, N. J.

Aeronautical personnel: J. J. Mascuch, president; A. L. Johnston, Jr., vice-president; J. T. Mascuch, secretary-treasurer; J. F. Lucas, sales manager; M. C. Healy, assistant secretary-treasurer; S. H. Roberts, production manager; F. G. Gardner and M. M. Eells, aircraft engineers.

Aeronautical products: Flexible shielded conduit (Army and Navy type). Conduit assemblies. Fittings. Hardware. Fuel and oil line fittings. Tab control assemblies. Radio ignition shielding. Tie rods.

BREWSTER AERONAUTICAL CORPORATION,
Long Island City, New York, New York

Aeronautical personnel: James Work, president; Dayton T. Brown, chief engineer; P. M. Stephenson, works manager; John R. Hunt, secretary-treasurer.

Aeronautical products: Exhaust manifolds (stainless steel). Hot spot assemblies. Aluminum alloy parts (engine ring cowls; cylinder head deflectors; firewalls; pilot's seats; radio tables; ammunition boxes; flotation gear containers). Fuel and oil tanks (aluminum alloy). Water-type landing gear (main float; wing tip floats; struts; wires; aluminum alloy and stainless steel). Wing cellules (aluminum alloy panels; ailerons; struts; wires). Tail surfaces (aluminum alloy elevator; rudder; stabilizer; fin; struts).

BROOKLYN VARNISH MFG. CO.,
35 Nostrand Ave., Brooklyn, N. Y.

Aeronautical products: Paint (bakelite primes and color coat).

BROWN & SHARPE MFG. CO.,
Providence, Rhode Island

Aeronautical personnel: H. B. Shott.

Aeronautical products: Cylinder barrels. Gears.

BUHL STAMPING CO., Detroit, Mich.

Aeronautical personnel: Harry Finkenstaedt, president.

Aeronautical products: Exhaust manifolds.

THE BUNTING BRASS & BRONZE CO.,
Toledo, Ohio

Branch offices: New York, N. Y.; Chicago, Ill.; San Francisco, Calif.; Boston, Mass.; Cleveland, O.; Detroit, Mich.; Los Angeles, Calif.; Seattle, Wash.; Dallas, Tex.; Brooklyn, N. Y.; Kansas City, Mo.; Cincinnati, O.; Philadelphia, Pa.; St. Louis, Mo.; Minneapolis, Minn.; Milwaukee, Wisc.; Newark, N. J.; Atlanta, Ga.

Aeronautical products: Bushings. Bearings. Washers (bronze). Bronze (bar). Castings (bronze).

BURD HIGH COMPRESSION RING CO.,
Rockford, Ill.

Aeronautical personnel: F. M. White, president and advertising manager.

Aeronautical products: Valve seats.

BURGESS NORTON MFG. CO.,
521 Peyton St., Geneva, Ill.

Aeronautical products: Piston pins. Link pins.

W. D. BYRON & SONS LEATHER COMPANY,
Williamsport, Md.

Aeronautical products: Upholstery (leather).

C

CALIFORNIA PANEL & VENEER COMPANY,
955 S. Alameda St., Los Angeles, Calif.

Aeronautical personnel: R. Mulholland.

Aeronautical products: Plywood.

CALIFORNIA SPRING CO.,
1746 S. Los Angeles, Los Angeles, Calif.

Aeronautical products: Springs.

CAMDEN FORGING CO., Camden, N. J.

Aeronautical products: Forgings (steel).

CANTON DROP FORGING & MFG. CO.,
1143 Willett Ave., S.E., Canton, Ohio

Aeronautical personnel: C. A. Brauchler, president and general manager; K. S. Goodin, secretary.

Aeronautical products: Forgings. Castings. Cylinder barrels. Crankshafts. Connecting rods. Gears.

GEORGE A. CARPENTER, Chicago, Ill.

Aeronautical products: Carpets.

THE CARPENTER STEEL CO., Reading, Pa.

Branch offices: Chicago, Ill.; Cleveland, O.; Detroit, Mich.; Hartford, Conn.; Indianapolis, Ind.; Milwaukee, Wisc.; New York, N. Y.; Philadelphia, Pa.; Providence, R. I.; Rochester, N. Y.; St. Louis, Mo.; Springfield, Mass. Branch warehouses: Chicago, Cleveland, Detroit, Hartford, Indianapolis, St. Louis.

Aeronautical products: Steel and steel alloys (chrome nickel; nickel steel; stainless; chrome ball; chrome-vanadium; chrome molybdenum).

THE CARROM CO., Ludington, Mich.

Aeronautical products: Plywood.

CARY SPRING WORKS, INC.,
240 W. 29th St., New York, N. Y.

Aeronautical products: Springs.

CENTRAL PANEL & SUPPLY COMPANY,
110 W. Commerce St., Cincinnati, O.

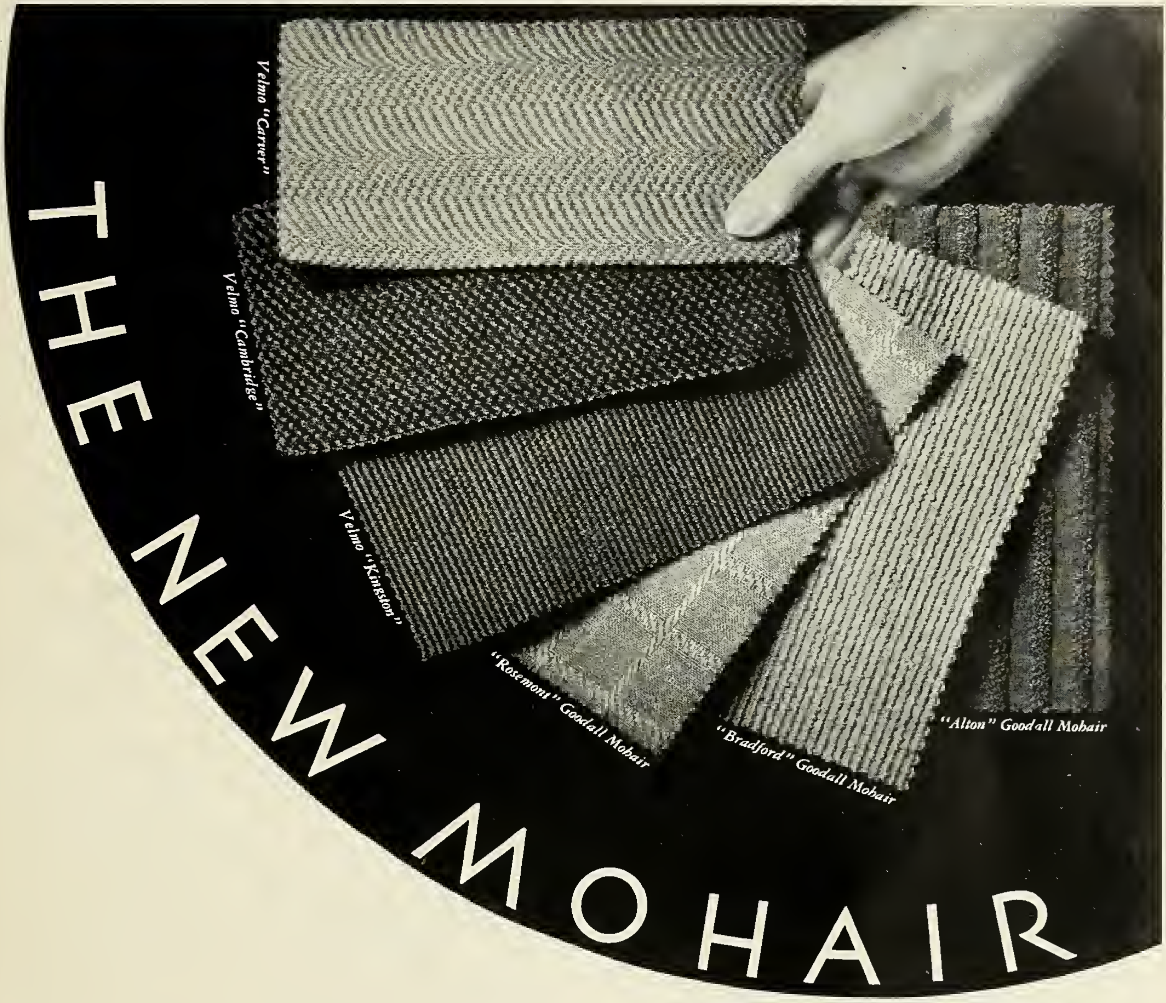
Aeronautical products: Plywood.

H. CHANNON CO., Chicago, Ill.

Aeronautical products: Asbestos.

(*Continued on following pages*)

Look for the Leader!



THE CAPACITY of mohair to take the wear and tear of daily service as seating upholstery may be news to some aviation officials . . . but take these facts from other transportation history before you specify any fabric:

Since 1882, railroads have almost exclusively used Mohair upholstery. The Goodall-Sanford mills, largest Mohair weavers in the world, have designed with and for them as style trends changed.

Since the first closed model, Mohair has been almost universally chosen for motor car upholstery. Other fabrics have been tried and found wanting in cleanliness, sturdiness, ease-on-passenger-clothing, and long-distance economy.

No finer mohair velvet is woven than Velmo. No smarter, more modern textures are woven than in Goodall flat Mohairs. No fabric or fibre has such capacity for service and satisfaction in the long . . . or short . . . run. Write Chase for proof!

VELMO UPHOLSTERIES
GOODALL MOHAIR PRINTS

Goodall-Sanford
INDUSTRIES

SEAMLOC BROADLOOM CARPET
LEATHERWOVE COATED FABRIC

L. C. CHASE & CO., Inc., *selling subsidiary of Goodall-Sanford.* 295 Fifth Avenue, New York
BOSTON CHICAGO DETROIT SAN FRANCISCO

Manufacturers of Fabricated Parts and Aircraft Materials (continued)

CENTRAL STEEL & WIRE CO.,
4545 S. Western Blvd., Chicago, Ill.

Aeronautical products: Steel (wire, cable tubing and sheet).

CHAMPION MACHINE & FORGING CO.
3695 E. 78th St., Cleveland, Ohio

Aeronautical products: Forgings (steel). Crankshafts. Camshafts. Connecting rods. Gears. Propeller hubs, and shafts. Rocker arms.

CHASE BRASS & COPPER CO.,
236 Grand, Waterbury, Conn.

Aeronautical personnel: Rodney Chase, advertising manager; E. J. Malvey, assistant advertising manager.

Aeronautical products: Brass. Bronze. Copper. Fuel line tubing.

L. C. CHASE., 295 Fifth Ave., New York, N. Y.

Factory: Goodall Sanford Industries, Sanford, Me.

Branch offices (selling division): Merchandise Mart, Chicago, Ill.; New Center Bldg., Detroit, Mich.; 442 Post St., San Francisco, Calif.

Aeronautical personnel: Goodall Worsted Mills, Sanford, Me., Everett Nutter; Sanford Mills B, Sanford, Me., Russell Goodall; L. C. Chase & Co.; G. B. Ogan, 295 Fifth Ave., New York, N. Y.; Geo. Sawyer, Statler Bldg., Boston, Mass.; H. Willias, 442 Post St., San Francisco, Calif.; A. E. Ronninger, New Center Bldg., Detroit, Mich.; Russell Warren, Merchandise Mart Bldg., Chicago, Ill.

Aeronautical products: Upholstery (mohair velvet *Velmo;* mohair fabric *Goodall Mohairs;* coated fabric *Leatherwove.* Carpeting (inlaid *Seamloc*).

CHENEY & SON, Manlius, N. Y.

Aeronautical personnel: J. P. Cheney, advertising manager.

Aeronautical products: Cylinder barrels.

CHICAGO COIL SPRING CO.,
318 N. Albany Ave., Chicago, Ill.

Aeronautical personnel: L. Wennerberg.

Aeronautical products: Springs.

CHICAGO CURLED HAIR CO., Chicago, Ill.

Aeronautical personnel: Arthur N. Horwich, president and sales manager; H. G. Broeker, engineer.

Aeronautical products: Insulation material (*Insulex*). Hair felt.

CHICAGO SCREW CO.,
1026 S. Homan Ave., Chicago, Ill.

Aeronautical products: Nuts and bolts.

CHICAGO TUBING & BRAIDING CO.,
310 N. Clinton St., Chicago, Ill.

Aeronautical products: Flexible tubing.

CLEVELAND TANNING COMPANY,
Denison Ave. & Jennings Rd., Cleveland, O.

Aeronautical personnel: Wm. G. Plumer, president; F. R. Wilhelmy, sales manager.

Aeronautical products: Leather *Aerokrome* (cockpit and cabin upholstery).

CLEVELAND WIRE SPRING CO.,
1281 E. 38th St., Cleveland, Ohio

Aeronautical personnel: J. W. Campbell, president.

Aeronautical products: Springs.

CLIMAX MOLYBDENUM COMPANY,
500 Fifth Ave., New York, N. Y.

Factory: Longeloth, Pennsylvania. Branch offices: Canton, Ohio; Chicago, Ill.; Detroit, Mich.; Los Angeles, Calif.: Pittsburgh, Pa.

Aeronautical products: Molybdenum (Ferro-molybdenum; calcium molybdate).

COAST CENTERLESS GRINDING,
Los Angeles, Calif.

Aeronautical products: Hardened and ground parts.

COFFEYS FELT CO., Kansas City, Mo.

Aeronautical products: Felt.

CONTINENTAL DIAMOND FIBRE COMPANY,
West Newark, Delaware

Aeronautical products: Fibre.

CONTINENTAL RUBBER WORKS, Erie, Pa.

Aeronautical personnel: Theron R. Palmer, president; Dr. P. H. Henkel, sales and general manager; Henry T. Fowler, general sales manager.

Aeronautical products: Rubber utilities.

COOK HEAT TREATING CO.,
Los Angeles, Calif.

Aeronautical products: Hardened and ground parts.

COOK PAINT & VARNISH COMPANY,
Kansas City, Missouri

Aeronautical personnel: R. A. Richardson, advertising manager.

Aeronautical products: Paint. Dope. Finishes.

CRAINE-SCHRAGE CO., Detroit, Mich.

Aeronautical products: Steel (bar).

CROSS, AUSTIN & IRELAND LUMBER CO.,
1246 Grand St., Brooklyn, N. Y.

Aeronautical products: Spruce.

THE CROWN CORK & SEAL CO.,
1508 Barclay St., Baltimore, Md.

Aeronautical personnel: D. O. Kimball, manager, contract machinery division.

Aeronautical products: Metal and cork (parts and assemblies fabricated to manufacturer's specifications for aircraft, aircraft engines and armament equipment).

CRUCIBLE STEEL COMPANY,
Chrysler Bldg., New York, N. Y.

Aeronautical personnel: J. J. Boylin.

Aeronautical products: Steel (bar, sheet and stainless parts).

D

DANLY MACHINE SPECIALTIES, INC.,
Cicero, Ill.

Aeronautical products: Bushings (steel).

DARDELET THREADLOCK CORPORATION,
120 Broadway, New York, N .Y.

Aeronautical products: Nuts and bolts.

DETROIT GASKET CO., Detroit, Mich.

Aeronautical personnel: Boyd S. Brown, in charge of sales.

Aeronautical products: Gaskets (*Steelbestos*).

THE DICKERSON STEEL COMPANY,
Davis and Meridian Ave., Dayton, Ohio.

Aeronautical personnel: Charles Dickerson.

Aeronautical products: Jobbers of chrome molybdenum bar and strip (3.5% nickel bars; SAE 1025 bar and strip; SAE 1095 strip; A & N specification alloys).

HENRY DISSTON & SONS, INC.,
Land Title Bldg., Philadelphia, Pa.

Aeronautical products: Steel (bar).

DOEHLER DIE CASTING CO., Batavia, N. Y.

Aeronautical products: Valve guides. Cylinder heads.

DOLPHIN PAINT & VARNISH COMPANY,
Champlain & Locust Sts., Toledo, O.

Aeronautical products: Cement.

DOW CHEMICAL CO., Midland, Mich.

Aeronautical personnel: Sherman W. Putnam; W. F. Stumpfig.

Aeronautical products: Air baffles. Aluminum (castings and extruded shapes).

DUCOMMON CORP., Los Angeles, Calif.

Aeronautical products: Tanks (oil and gas). Copper tubing.

DU PONT VISCOLOID COMPANY, INC.
350 Fifth Avenue, New York, N. Y.

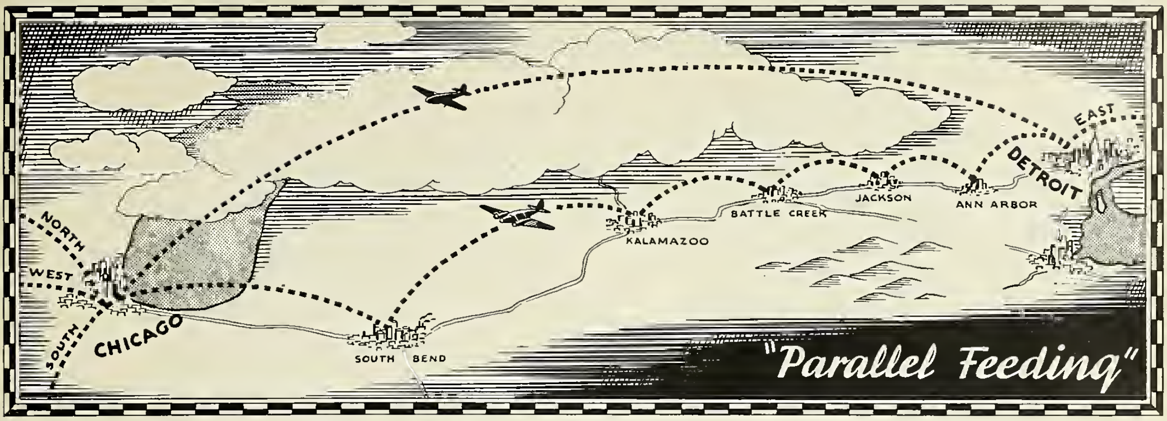
Factories: Doyle Works, Leominster, Mass.; Arlington, N. J. Finishing Division: E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Branch offices: North American Bldg., Chicago, Ill.; 601 Third St., San Francisco, Calif.

Aeronautical personnel: W. A. Joslyn, director of sales, Arlington, N. J.

Aeronautical products: Transparent sheeting (*Pyralin* and *Plastacele* body lights; turret lights; running lights, fuel gauge). Windshield. Paint. Dope. Varnish. Lacquer.

(*Continued on following pages*)



From Kalamazoo Direct to - -

NEW YORK - BOSTON - WASHINGTON - MIAMI
NEW ORLEANS - DALLAS - WEST COAST

STINSON TRIMOTORED AIRLINERS, operated by American Airlines, have reopened a great transportation market in the five prosperous cities between Detroit and Chicago.

A year ago Kalamazoo travelers lacked fast air service. If they wished to visit New York they generally used the railroad. Result, they lost time and the Airline lost revenue.

Now the people of all five cities may leave home or office at the close of the day, are speeded to Detroit on American Airlines' Stinson Trimotored Airliner, make quick connection there with a through plane and arrive in New York at 10:20 P. M.

They may leave home in the morning, spend the day in Chicago and return home in the evening, or make fast connections at Chicago arriving in St. Louis, Louisville, Tulsa or Oklahoma City that afternoon; in Atlanta, New Orleans, Miami, Dallas or Ft. Worth that evening and in Los Angeles in time for work the next morning.

This fine service has been made possible by the Stinson Trimotored Airliner, fastest of its type in America, and built specially to give high-speed service on frequent stop runs and to "Parallel Feed" the through services.

"Parallel Feeding" means providing modern high-speed service to hundreds of important cities on main Airlines which are now neglected or poorly served. These cities are entitled to and will support better service, just as Kalamazoo and its sister cities have responded to the time saving schedules made possible by Stinson Airliners.

To better serve their territories Delta and Central Airlines have ordered fleets of Stinson Trimotors and will shortly inaugurate the fastest services between Dallas, Tyler, Shreveport, Monroe, Jackson, Meridian, Birmingham and Atlanta; and between Detroit, Cleveland, Akron, Pittsburgh and Washington.

THE STINSON TRIMOTORED AIRLINER, AMERICA'S FASTEST AND MOST ECONOMICAL TRIMOTOR

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STINSON AIRCRAFT CORPORATION
Division Aviation Manufacturing Corp.
WAYNE • MICHIGAN • U. S. A.

Manufacturers of Fabricated Parts and Aircraft Materials (continued)

E

EAGLE OTTAWA LEATHER COMPANY,
Grand Haven, Michigan

Aeronautical personnel: E. K. Ellis, sales and advertising manager.

Aeronautical products: Upholstery (leather).

EASTERN MALLEABLE IRON CO., INC.,
Naugatuck, Conn.

Aeronautical products: Castings (steel).

ECLIPSE AVIATION CORP., E. Orange, N. J.

Factories: (foundry division) 1265 McBride Ave., Little Falls, N. J.

Aeronautical personnel: Charles Marcus, president; R. P. Lansing, vice-president; H. A. Gossner, secretary; W. J. Buettner, treasurer; C. H. Knoch, assistant secretary-treasurer; A. E. Raabe, sales manager and assistant secretary.

Aeronautical products: Castings (magnesium alloy; aluminum alloy; bronze alloy). Engine inertia, direct hand and air injection starters. Generators. Dynamotors. Instrument pumps. Suction regulating valves. Deicer equipment. Fuel flowmeters. Automatic variable pitch propeller hub. Electric landing gear motors. Battery booster coils. Booster magnetos. Automatic supercharger regulators. Superchargers. Flexible metallic tubing.

EGYPTIAN LACQUER COMPANY,
90 West St., New York, N. Y.

Aeronautical personnel: Frank G. Drake.

Aeronautical products: Paints. Enamels.

ELASTIC STOP NUT CORP., Elizabeth, N. J.

Aeronautical personnel: A. Swanson, president and general manager; H. B. Thomas, vice-president and sales manager.

Aeronautical products: Stop nuts (steel; brass; duralumin).

ELLFELDT HARDWARE COMPANY,
1300 Walnut St., Kansas City, Mo.

Aeronautical products: Fibre.

EMSCO ASBESTOS CO., Downey, California.

Aeronautical personnel: E. M. Smith.

Aeronautical products: Rivets (aluminum).

ENDICOTT FORGING & MFG. CO.,
Endicott, N. Y.

Branch offices: New York, N. Y.; Boston, Mass.; Detroit, Mich.; Pittsburgh and Philadelphia, Pa.; Cleveland and Cincinnati, Ohio; Indianapolis, Ind.

Aeronautical personnel: A. W. Schaefer.

Aeronautical products: Forgings (steel). Camshafts. Gears.

ENGLE AIRCRAFT SPECIALTIES,
1729 Standard Ave., Glendale, Calif.

Aeronautical personnel: John H. Engel, president.

Aeronautical products: Streamlinings (NACA cowling; speed rings; nose spinners; wheel pants). Cooling deflectors. Oil radiators. Cowlings. Exhaust rings (stainless steel; monel metal; 1025 steel; commercial steel). Radio shielding (copper; steel).

EX-CELL-O AIRCRAFT & TOOL CORP.,
1200 Oakman Blvd., Detroit, Mich.

Aeronautical personnel: N. A. Woodworth, president and general manager; Wm. F. Wise, manager of sales.

Aeronautical products: Piston pins. Valve guides (aluminum; bronze). Precision aircraft engine parts (pump shaft; relief valves; ball ends and sockets; timing pinion bolt and washers; rollers; spacers; rocker arm axle; propeller hub nut; tachometer shaft; bushings; pump shaft; piston pin and plugs; cam followers; engine nuts and bolts).

F

THE FAFNIR BEARING CO., New Britain, Conn.

Branch offices: 288 Spring St., Atlanta, Ga.; 9 S. Clinton St., Chicago, Ill.; Union Bldg., Cleveland, O.; 2825 Commerce St., Dallas, Tex.; New Center Bldg., Detroit, Mich.; 1625 Grand Ave., Kansas City, Mo.; 1834 Broadway, New York, N. Y.; 3701 N. Broad St., Philadelphia, Pa.; 2638 W. Lynn St., Seattle, Wash.

Aeronautical personnel: C. F. Stanley, sales manager; D. L. Holbrook, sales engineer for the aircraft division, in charge of research and development; C. G. Rosensweig, production manager.

Aeronautical products: Ball bearings (single row radial; single row radial thrust; straight thrust; rigid or self aligning double metal shield; rigid or self aligning double felt seal; light single row without seals).

FARRELL-CHECK STEEL FOUNDRY,
Sandusky, Ohio

Aeronautical personnel: C. C. Hottman, sales department.

Aeronautical products: Castings (steel).

THE FEDERAL BEARINGS CO., INC.,
Poughkeepsie, New York

Factory (Ball branch): The Waterbury Steel Ball Co., Inc., Chicago, Ill.

Branch offices: Book Tower, Detroit, Mich.; 120 N. Peoria St., Chicago, Ill.

Aeronautical personnel: H. A. Schatz, president; G. H. Schatz, secretary.

Aeronautical products: Ball bearings (double oil shield single row, double row, and self aligning; torque tube; single row radical with and without oil shield and double oil shield; single row radial felt-lab seal; separable; self aligning double row radial).

FEDERAL MOGUL CORP.,
Shoemaker & Lillibridge Sts., Detroit, Mich.

Aeronautical personnel: D. W. Rodgers; S. C. Reynolds.

Aeronautical products: Copper alloys (brass and bronze bars). Bushings (bronze). Bearings.

THE FELTERS COMPANY, INCORPORATED,
210 South Street, Boston, Mass.

Factories and Mills: Millbury, Mass.; Johnson City, N. Y.; Middleville, N. Y.; Jackson, Mich.

Branch offices: New York, N. Y.; Philadelphia, Pa.; Dallas, Tex.; Detroit, Mich.; St. Louis, Mo.; Chicago, Ill.; San Francisco, Calif.

Aeronautical personnel: W. C. King, president; F. S. Peck, vice-president; L. H. Hansel, vice-president and treasurer; S. S. Reid, assistant treasurer.

Aeronautical products: Felt (washers; wicks: tabs; weatherstripping; insulation; bonded metal).

FESSENDEN HALL, Philadelphia, Pa.

Aeronautical products: Plywood.

FIRESTONE TIRE & RUBBER CO., Akron, Ohio

Factories: 1278 South Main St., Akron, O.; 2525 Firestone Blvd.; Los Angeles, Calif.

Aeronautical personnel: W. S. Wilson, aircraft sales manager; J. E. Hale, research manager; T. E. Pittenger, production manager.

Aeronautical products: Rubber utilities (mechanical parts; tubing). *Firestone* tires.

FIRTH-STERLING STEEL COMPANY,
710 W. Lake St., Chicago, Ill.

Plant: McKeesport, Pa.

Aeronautical products: Steel (bar).

FISCHER BALL BEARING CORPORATION,
33 W. 60th St., New York, N. Y.

Aeronautical personnel: A. Golden, sales manager.

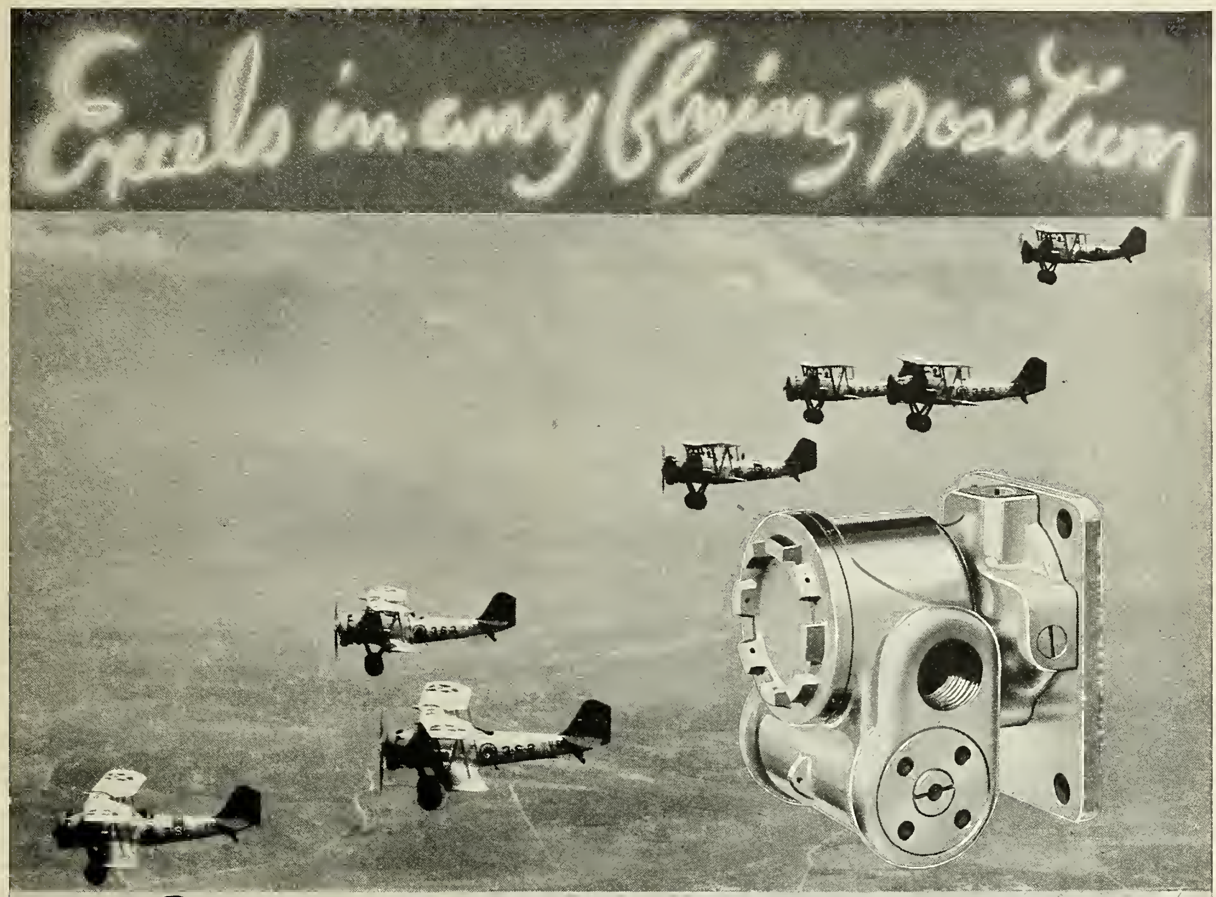
Aeronautical products: Bearings.

FITZGERALD MFG. CO., Torrington, Conn.

Aeronautical personnel: P. J. Fitzgerald, president; B. G. Peck, sales manager in charge of advertising.

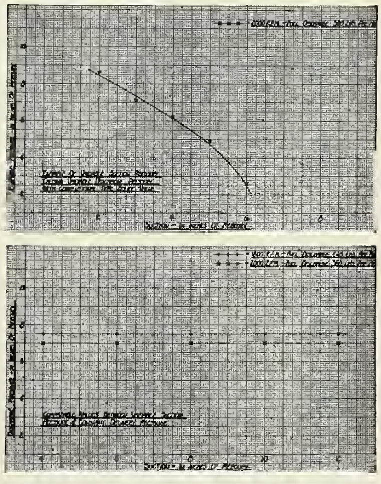
Aeronautical products: Gaskets.

(*Continued on following pages*)



Evans NEW TYPE Aircraft FUEL PUMP.. the E-9

For the first time in aviation, a fuel pump has been developed which is reliable, efficient, and fool proof. The new EVANS E-9 maintains correct pressure on the carburetor at all times, regardless of air conditions, temperature, or flying position. A sylphon relief valve assures constant pressure, regardless of the suction head, and the pump is constructed so that a wabble pump can be used in conjunction without affecting the relief valve. Pilots and transportation companies will welcome the EVANS E-9 as a most valuable contribution to flight security.



Charts 1 and 2, above, show the difference in pressure control with the conventional by-pass relief valve and the new sylphon relief valve. The sylphon eliminates relief pressure variation under all suction conditions. This valve permits an instantaneous prime at extremely low engine r.p.m. It can be adjusted at any pressure from 2 to 10 pounds by simple manual adjustment.

THE EVANS APPLIANCE COMPANY

New York Office
90 West St.
New York, N. Y.

253 Vinewood Ave.
Detroit, Mich.
Cable Address: EVCO-Detroit

West Coast Representatives
Pacific Airmotive Corp., Ltd.
Union Air Term., Burbank, Calif.

SEE THE NEW EVANS E-9 AIRCRAFT FUEL PUMP
at the

ALL AMERICAN AIRCRAFT SHOW
DETROIT—JULY 20 to 28th INCLUSIVE

Manufacturers of Fabricated Parts and Aircraft Materials (continued)

CHARLES FISCHER SPRING COMPANY,
240 Kent Ave., Brooklyn, N. Y.

Aeronautical personnel: Sidney Fischer.

Aeronautical products: Springs.

FLEETWINGS, INCORPORATED
Radcliffe St., Bristol, Pa.

Aeronautical personnel: Carl de Ganahl, president; G. S. Ireland, vice-president; W. L. Sutton, chief engineer; A. M. Carlson, secretary and treasurer.

Aeronautical products: Tanks (shotwelded stainless steel). Wing ribs. Wing beams. Control surfaces.

FORMICA INSULATION COMPANY,
4648 Spring Grove Ave., Cincinnati, O.

Aeronautical personnel: W. G. Steiner.

Aeronautical products: Pulleys. Insulation material. Fibre.

PETER A. FRASSE & CO.,
Grand St., & 6th Ave., New York, N. Y.

Aeronautical products: Steel (tubing, bar, sheet and stainless parts).

W. P. FULLER & COMPANY,
301 Mission, San Francisco, Calif.

Aeronautical personnel: W. P. Fuller, Jr., president; D. L. Fuller, advertising manager and sales promotion manager.

Aeronautical products: Enamels. Dope. Lacquer.

G

GEM CITY SHEET METAL CO.,
472 Huffman Ave., Dayton, Ohio

Aeronautical products: Streamlinings.

GENERAL DROP FORGE CO., INC.,
Buffalo, New York

Aeronautical personnel: W. B. Breyley.

Aeronautical products: Forgings (steel).

GENERAL CABLE CORPORATION,
420 Lexington Ave., New York, N. Y.

Factory: Rome, New York.
Aeronautical products: Cable. Radio shielding. Ignition wiring.

GENERAL METALS CO., Los Angeles, Calif.

Aeronautical products: Cylinder barrels. Forgings (steel).

GENERAL TIRE & RUBBER Co., Akron, Ohio

Aeronautical personnel: Wm. O'Neil, president; Ray W. Brown, Robert Iredell, Alger G. Maranville, aeronautical representatives.

Aeronautical products: Rubber utilities (grommets; sheeting; packing). Tires and tubes (*Streamline;* intermediate low pressure type).

W. D. GIBSON COMPANY,
1800 Claybourn Ave., Chicago, Ill.

Aeronautical products: Springs.

THE GLIDDEN CO., Cleveland, O.

Factories: (Paint, lacquer and varnish) Cleveland, O.; Reading, Pa.; Toronto, Ont., Canada; 1853 N. LeClaire St., Chicago, Ill.; 1300 Seventh St., San Francisco, Calif. (Paint and varnish) 424 Josephine St., New Orleans, La.; 1901 E. Hennepin Ave., Minneapolis, Minn.; Main & Gratiot Sts., St. Louis, Mo.

Branch offices: 44 Midway St., Boston, Mass.; 2111-44 St., Long Island City, N. Y.; 1901 E. 61 St., Los Angeles, Calif.; 1215 Elm St., Dallas, Tex.; 2016 First Ave., Birmingham, Ala.; 36 W. Flagler St., Miami, Fla.; 412 Tampa Ave., Tampa, Fla.; 216 Olive St., West Palm Beach, Fla.; 1245 S. Beretania St., Honolulu.

Aeronautical personnel: (Cleveland) D. P. Joyce, vice-president; G. B. Work, direct sales promotion manager. (Reading) M. J. Pearce, industrial sales manager. (Chicago) G. S. Hamilton, industrial sales manager. (San Francisco) P. L. Lotz, regional director. (New Orleans) W. G. Smart, regional director. (Dallas) L. A. Day, regional director. (St. Louis) L. S. Fulton, regional director. (Boston) F. M. Baird, regional director. (Long Island) V. P. Mueller, sales manager. (Toronto) G. C. Mowat, regional director. (Minneapolis) W. C. Henke, regional director. (Birmingham) J. L. Beauchamp. (Miami) J. A. Gaddis. (Tampa) J. C. Brown. (W. Palm Beach) L. C. Driggers. (Honolulu) B. R. McBride.

Aeronautical products: *Glidair* paint. Lacquer. Dope. Enamel. Varnish. Primer. Fabric restorer (*Fabricote*).

GOETZ GASKET & PACKING COMPANY,
New Brunswick, New Jersey

Aeronautical products: Gaskets.

GOODALL RUBBER CO., Philadelphia, Pa.

Branch offices: New York, N. Y.; Pittsburgh, Pa.; Chicago, Ill.; Boston, Mass.; Trenton, N. J.; Cleveland, O.

Aeronautical personnel: R. F. Slaughter.

Aeronautical products: Rubber utilities (*Newtype Cord* refueling hose; *Goodall* fire hose; molded pieces; flat washers; paint spray hose).

THE B. F. GOODRICH CO., Akron, Ohio.

Factories: Akron, O.; Los Angeles, Calif.; Kitchener, Ontario, Canada.

Branch offices: 1043 Broadway, Albany, N. Y.; 376 Nelson St., S. W., Atlanta, Ga.; 109 Brookline Ave., Boston, Mass.; 1050 Main St., Buffalo, N. Y.; 4th & Brevard Sts., Charlotte, N. C.; 310 W. Taylor St., Chicago, Ill.; Central Parkway at Sycamore St., Cincinnati, O.; 4700 Prospect Ave., Cleveland, O.; 4136 Commerce St., Dallas, Tex.; 2625 Walnut St., Denver, Colo.; 10430 Locust St., Des Moines, Ia.; 2792 E. Grand Blvd., Detroit, Mich.; 2009 Capitol Ave., Houston, Tex.; 2422 Broadway, Kansas City, Mo.; 5400 E. Ninth, Los Angeles, Calif.; 839 N. Jefferson, Milwaukee, Wis.; 306 First Ave. N., Minneapolis, Minn.; 133 Frelinghuysen Ave., Newark, N. J.; 1742 St. Charles Ave., New Orleans, La.; 619 W. 54th St., New York, N. Y.; 2034 Farnam St., Omaha, Neb.; 1955 Hunting Park Ave., Philadelphia, Pa.; 5740 Baum Blvd., Pittsburgh, Pa.; 4481 Duncan Ave., St. Louis, Mo.; 355 Brannan St., San Francisco, Calif.; 1049 Railroad Ave. S., Seattle, Wash.; 1522 14 St., N. W., Washington, D. C.

Aeronautical personnel: T. A. Aspell, general sales manager; J. S. Pedler, manager aeronautical sales department

Aeronautical products: Rubber utilities (spark plug nipples; grommets; radiator hose; refueling hose; ventilator hose; handle grips; *Air Speed tubing;* shock absorber discs; pontoon hand-hole covers; shock absorber cord; matting; window channel). Cement (airship seam; soundproofing; water seal). Sheet rubber. Sponge rubber. *Silvertown* tires and tubes. *Cactus-Proof* tubes. Pneumatic tail wheels. Solid rubber tail wheels. Abrasion shoes. De-icers.

GOODYEAR TIRE & RUBBER CO.,
Akron, Ohio

Aeronautical personnel: L. O. Guinther, manager of aviation sales; H. M. White, assistant manager of aviation sales; L. D. Judd, director of advertising; K. C. Zonsius, acting advertising manager.

Aeronautical products: Rubber utilities. Goodyear tires and tubes.

GOVRO-NELSON CO., Detroit, Mich.

Aeronautical personnel: Victor Gauvreau.

Aeronautical products: Cylinder heads. Cylinder barrels. Crankcases. Crankshafts. Valve seats. Connecting rods. Hardened and ground parts.

GREIST MANUFACTURING CO.,
2119 Water St., New Haven, Conn.

Aeronautical products: Link pins.

A. P. GRIMM FOUNDRY COMPANY,
Bound Brook, New Jersey

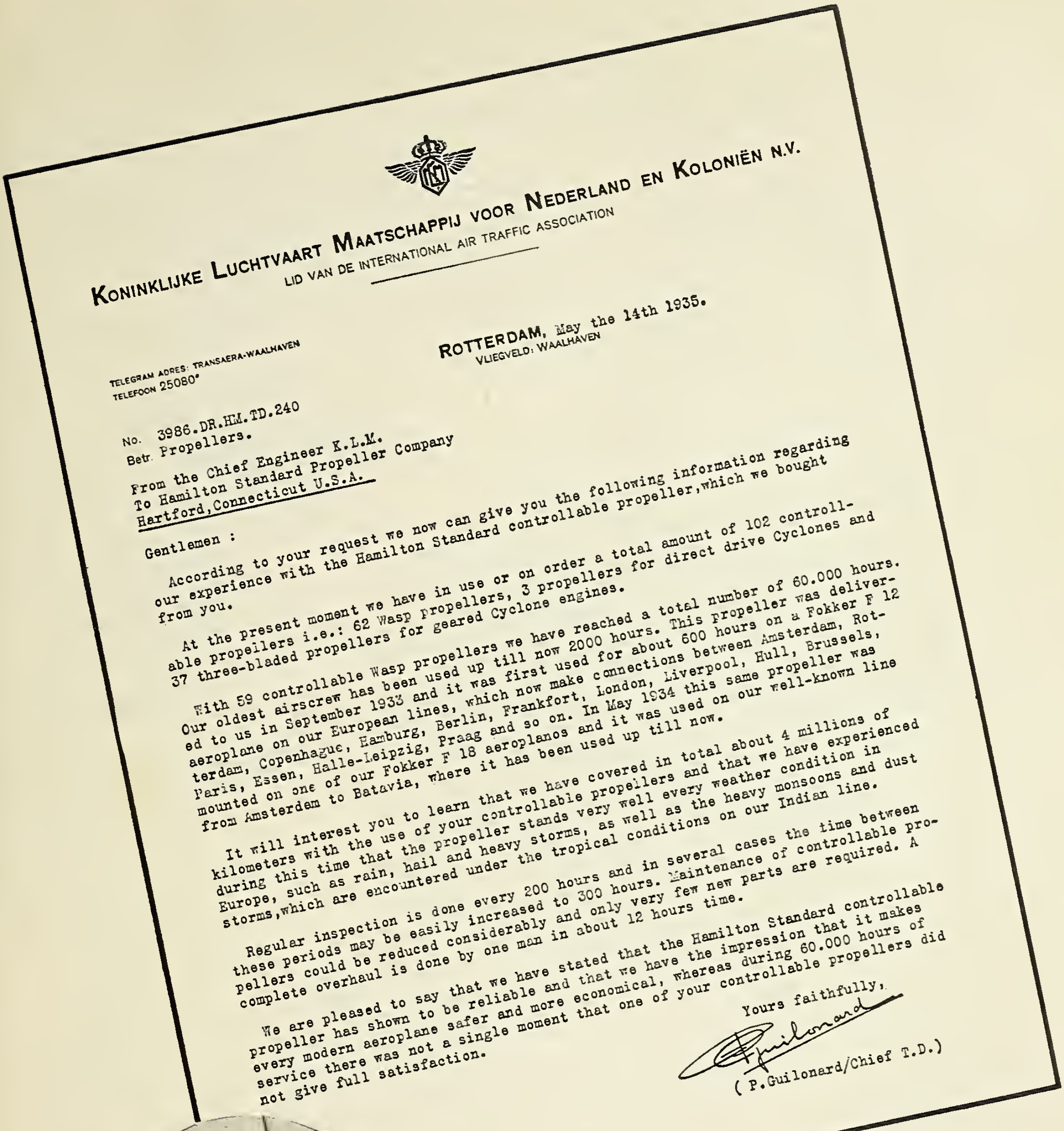
Aeronautical products: Castings (steel).

H

THE HAMILTON FOUNDRY & MACHINE COMPANY,
Hamilton, Ohio

Aeronautical personnel: Peter E. Rent-

(*Continued on following pages*)



Koninklijke Luchtvaart Maatschappij voor Nederland en Koloniën N.V.
LID VAN DE INTERNATIONAL AIR TRAFFIC ASSOCIATION

TELEGRAM ADRES: TRANSAERA-WAALHAVEN
TELEFOON 25080°

ROTTERDAM, May the 14th 1935.
VLIEGVELD: WAALHAVEN

No. 3986.DR.HM.TD.240
Betr. Propellers.

From the Chief Engineer K.L.M.
To Hamilton Standard Propeller Company
Hartford,Connecticut U.S.A.

Gentlemen :

According to your request we now can give you the following information regarding our experience with the Hamilton Standard controllable propeller,which we bought from you.

At the present moment we have in use or on order a total amount of 102 controllable propellers i.e.: 62 Wasp propellers, 3 propellers for direct drive Cyclones and 37 three-bladed propellers for geared Cyclone engines.

With 59 controllable Wasp propellers we have reached a total number of 60.000 hours. Our oldest airscrew has been used up till now 2000 hours. This propeller was delivered to us in September 1933 and it was first used for about 600 hours on a Fokker F 12 aeroplane on our European lines, which now make connections between Amsterdam, Rotterdam, Copenhague, Hamburg, Berlin, Frankfort, London, Liverpool, Hull, Brussels, Paris, Essen, Halle-Leipzig, Praag and so on. In May 1934 this same propeller was mounted on one of our Fokker F 18 aeroplanos and it was used on our well-known line from Amsterdam to Batavia, where it has been used up till now.

It will interest you to learn that we have covered in total about 4 millions of kilometers with the use of your controllable propellers and that we have experienced during this time that the propeller stands very well every weather condition in Europe, such as rain, hail and heavy storms, as well as the heavy monsoons and dust storms,which are encountered under the tropical conditions on our Indian line.

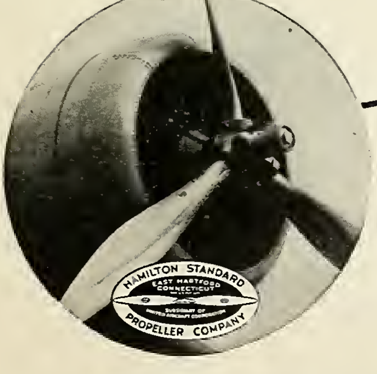
Regular inspection is done every 200 hours and in several cases the time between these periods may be easily increased to 300 hours. Maintenance of controllable propellers could be reduced considerably and only very few new parts are required. A complete overhaul is done by one man in about 12 hours time.

We are pleased to say that we have stated that the Hamilton Standard controllable propeller has shown to be reliable and that we have the impression that it makes every modern aeroplane safer and more economical, whereas during 60.000 hours of service there was not a single moment that one of your controllable propellers did not give full satisfaction.

Yours faithfully,

P. Guilonard

(P.Guilonard/Chief T.D.)



K. L. M. one of the world's outstanding airlines, has placed its seal of approval on Hamilton Standard Controllables. 102 of these propellers now installed on the planes of the Royal Dutch Airlines are providing satisfactory service under varied conditions of operation from Holland to Java.

HAMILTON STANDARD PROPELLER COMPANY • EAST HARTFORD, CONNECTICUT

schler, president; Don McDaniel, vice-president.

Aeronautical products: Castings (Meehanite metal engine cylinders).

HAMILTON STEEL CO., Cleveland, Ohio

Aeronautical products: Tubing. Castings. Steel (bar, sheet and stainless parts).

HALCOMB STEEL COMPANY, Geddes St., Syracuse, N. Y.

Aeronautical products: Steel (bar and sheet).

HARTFORD MACHINE SCREW CO., 476 Capital Street, Hartford, Conn.

Aeronautical products: Nuts and bolts. Hardened and ground parts.

STEWART HARTSHORN CO., 250 Fifth Ave., New York, N. Y.

Plant: Harrison, New Jersey.

Aeronautical personnel: Louis P. Bayard.

Aeronautical products: Tie rods. Steel (wire and stainless parts).

HASKELITE MANUFACTURING CORP., 208 West Washington St., Chicago, Ill.

Factory: Grand Rapids, Mich.

Branch office: 152 W. 42nd St., New York, N. Y.

Aeronautical personnel: James R. Fitzpatrick, vice-president in charge of sales; Prof. O. H. Basquin, chief engineer; C. B. Norris, mechanical engineer; C. E. Scott, New York representative.

Aeronautical products: Plywood (*Haskelite;* structural, sound insulating). Flooring and cabin lining (Aluminum *Plymetl*). *Ornametl* cabin lining.

HAZARD WIRE ROPE CO., New York, N. Y.

Aeronautical personnel: Jay O. Lashar.

Aeronautical products: Steel wire. Steel cable.

GEORGE A. HEBB COMPANY, 102 Murray St., Newark, N. J.

Aeronautical products: Springs.

THEODORE HERGERT, INCORPORATED, 422 East 53rd St., New York, N. Y.

Aeronautical products: Streamlinings.

HILL AIRCRAFT STREAMLINERS COMPANY 814 Reedy St., Cincinnati, Ohio

Aeronautical personnel: John A. Hill, president; Kenneth W. Abbott, secretary; Werner A. Sundquist, factory superintendent.

Aeronautical products: Streamlinings (NACA cowlings; speed rings; engine nacelles; wheel fairings; wing root fairings; spinners). Fuel and oil tanks.

HILO VARNISH CORPORATION, 42-60 Stewart Ave., Brooklyn, N. Y.

Branch offices: Chicago, Ill.; Boston, Mass.; Philadelphia, Pa.

Aeronautical personnel: Carl J. Schumann, president and sales manager; Joseph Mattiello, technical director.

Aeronautical products: Paint (semi-gloss black baking japan and finishing black baking japan for engine cylinders; *Crystal* finishes for instruments, cameras, etc.). Enamel (for camera interiors *Dull Black*). Varnish. Lacquer.

HIRST-ROGERS CO., North Wales, Pa.

Aeronautical products: Carpets.

C. W. HOUSE & SONS, 505 Fifth Ave., New York, N. Y.

Aeronautical products: Felt.

I

IMPERIAL BRASS MFG. CO., 524 S. Racine Ave., Chicago, Ill.

Aeronautical personnel: C. H. Benson.

Aeronautical products: Valves. Fuel system fittings.

INDIANA GEAR WORKS, 1457 E. 19th St., Indianapolis, Ind.

Aeronautical personnel: Lewis G. Beuhler, president.

Aeronautical products: Camshafts. Piston pins. Valve guides. Gears.

INDIANA VENEER AND PANEL COMPANY, New Albany, Indiana

Branch office: Crescent Panel Co., Inc., 3229 W. Market St., Louisville, Ky.

Aeronautical personnel: C. M. Hilton, director of sales.

Aeronautical products: Plywood.

INDUSTRIAL STEEL CASTING CO., Toledo, Ohio

Aeronautical products: Castings (steel).

J

IADSON MOTOR PRODUCTS CO., 8353 Wilcox Ave., Bell, Calif.

Aeronautical personnel: P. J. Sampson.

Aeronautical products: Valves.

JOHNS MANVILLE, INC., New York, N. Y.

Aeronautical personnel: Lewis H. Brown, president; L. R. Hoff, vice-president and general sales manager; H. M. Shackelford, advertising manager and sales promotion manager.

Aeronautical products: Asbestos. Insulation material. Soundproofing material.

JONES-DABNEY CO., INC., Louisville, Ky.

Factories: Louisville, Ky.; Detroit, Mich.

Branch offices: Chicago, Ill.; Detroit, Mich.; Evansville, Ind.; Fort Smith, Ark.; Grand Rapids, Mich.

Aeronautical personnel: E. D. Horgan, divisional sales manager (Louisville).

Aeronautical products: Dope. Lacquer. Varnish. Enamel.

W. B. JONES SPRING COMPANY, 809 Walnut St., Cincinnati, O.

Aeronautical products: Springs.

K

THE KAY & ESS COMPANY, Kiser & Leo Sts., Dayton, Ohio

Aeronautical personnel: A. J. Turner, vice-president in charge of aeronautical sales; W. H. Pesola, director of research.

Aeronautical products: Enamel. Aluminum liquid. Dope (*Superloid*). Lacquer.

KLINE SPRING CO., Cleveland, Ohio

Aeronautical products: Springs.

THE OTTO KONIGSLOW MANUFACTURING CO. 3610 Perkins Ave., Cleveland, Ohio

Aeronautical personnel: Otto Konigslow, Jr., president; D. C. Lowles, vice-president; M. E. Konigslow, secretary-treasurer.

Aeronautical products: Stampings (special sheet metal manufactured to specifications).

KRODEL FOUNDRY, Waterbury, Conn.

Aeronautical products: Castings (bronze and aluminum).

L

LADISH DROP FORGE COMPANY, Cudahy, Wisconsin

Aeronautical personnel: R. M. Foltz, vice-president in charge of sales.

Aeronautical products: Forgings (engine crankshafts, connecting rods, camshafts, rocker arms, gears; propeller blades and fixed- and controllable-pitch propeller hubs; control fittings; landing gear parts; solid and hollow tail wheel knuckles).

THE LAIDLAW COMPANY, INC., 16 W. 60 St., New York, N. Y.

Factories and Mills: Monson, Mass.; Pawtucket, R. I.; Philadelphia, Pa.

Aeronautical personnel: Wm. R. Laidlaw, president and treasurer; Edmund F. Griffin, aeronautical sales; G. A. Havemeyer, sales promotion and research.

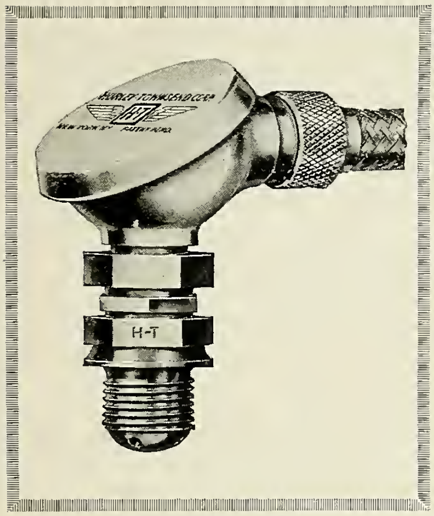
Aeronautical products: Upholstery (cabin

(Continued on following pages)

Announcing

BENDIX H-T AIRCRAFT SPARK PLUGS

MADE BY SCINTILLA MAGNETO CO., INC.



SCINTILLA engineers have developed a new spark plug for aircraft engines, having many features not hitherto seen in spark plug practice. This will shortly be placed on the market in types adapted to leading aircraft engines.

In addition, the assets and manufacturing facilities of the Hurley-Townsend Corporation have been acquired and will be re-located at the Scintilla plant in Sidney, N. Y. This enables the Scintilla organization to supply a complete line of aircraft engine spark plugs for every requirement.

The merchandising of these spark plugs to the trade will be handled by Scintilla Aircraft Magneto Distributors and Service Stations, which are located at most of the large airports and at other points throughout the country.

The addition of spark plugs to the present line of aircraft magnetos, battery ignition, switches, etc., is a logical development which will enable Scintilla to serve the aircraft industry even more effectively than in the past.

SCINTILLA MAGNETO CO., INC.
(Subsidiary of Bendix Aviation Corporation)
SIDNEY, N. Y.

interior). Textile trimmings. Carpets. Curtain silks. Silk cord hat and luggage racks. Seat cover cloths.

LEBANON STEEL FOUNDRY, Lebanon, Pa.

Branch office: 3701 N. Broad St., Philadelphia Pa.

Aeronautical personnel: W. H. Worrilow, president; T. S. Quinn, treasurer; K. V. Wheeler, general manager; A. C. Jones, research engineer; T. V. Blodgett, sales manager; P. E. Gerhard, sales engineer.

Aeronautical products: Castings (manufactured to specifications from *Circle "L"* No. 2 manganese-chrome-molybdenum steel; No. 3 manganese-chrome-molybdenum steel; and No. 23 stainless steel).

LEE SPRING CO., INC.,
30 Main St., Brooklyn, N. Y.

Aeronautical personnel: W. D. Gent.

Aeronautical products: Springs.

W. LEECHBURG STEEL CO., Leechburg, Pa.

Aeronautical products: Steel (sheet).

LELAND GIFFORD COMPANY,
1025 Southbridge St., Worcester, Mass.

Aeronautical personnel: S. B. Dowd; A. J. Gifford.

Aeronautical products: Crankshafts.

LEWIS STREET GLASS COMPANY,
216 W. Lewis St., Wichita, Kansas

Aeronautical products: Cabin glass.

LIBBEY-OWENS-FORD GLASS COMPANY
Nichols Bldg., Toledo, Ohio

Factories: Toledo, O.; Rossford, O.; Charleston, W. Va.; Shreveport, La.; Ottawa, Ill.

Branch offices: General Electric Bldg., New York, N. Y.; Syracuse Hotel, Syracuse, N. Y. (under New York supervision); Integrity Bldg., Philadelphia, Pa.; Statler Bldg., Boston, Mass.; 250 Delaware Ave., Buffalo, N. Y.; Fisher Bldg., Detroit, Mich.; P. O. Box 659, Suffolk, Va.; Bona Allen Bldg., Atlanta, Ga.; American Bldg., Cincinnati, O.; Conway Bldg., Chicago, Ill.; 910 E. Wisconsin Ave., Milwaukee, Wis. (under Chicago supervision); Wesley Temple Bldg., Minneapolis, Minn.; R. A. Long Bldg., Kansas City, Mo.; P. O. Box 1401, Denver, Colo. (under Kansas City supervision); Rialto Bldg., San Francisco, Calif.; P. O. Box 3142, Seattle, Wash. (under San Francisco supervision); Architects Bldg., Los Angeles, Calif.; Shreveport, La.; P. O. Box 2274, Dallas, Tex. (under Shreveport supervision).

Aeronautical personnel: G. P. MacNichol, Jr., vice-president in charge of sales; George B. Watkins, chief engineer in charge of research.

Aeronautical products: Safety glass.

LINCOLN MACHINE & TOOL CO.,
1068 Main St., Pawtucket, R. I.

Aeronautical products: Connecting rods.

LORD MANUFACTURING CO., Erie, Pa.

Factory: 1316 Holland St., Erie, Pa.

Aeronautical personnel: Thomas Lord, president; T. L. Yates.

Aeronautical products: Rubber utilities (plate form shear type mountings for instruments, instrument panels; radio, battery box containers; chair leg cushions). Bonded rubber channel strips (for cabin glass or landing light window supports). Tube form mountings (engine mountings).

LOS ANGELES SPRING & FORGE CO.,
1948 E. Los Angeles, Los Angeles, Calif.

Aeronautical products: Springs.

THE LOWE BROTHERS COMPANY,
452 E. 3d St., Dayton, Ohio

Aeronautical personnel: D. A. Kohr, president and general manager; L. L. Anderson, sales manager; R. E. Mercer, advertising manager.

Aeronautical products: Enamels. Varnish. Paint.

LUMEN BEARING CO.,
215 Lathrop St., Buffalo, N. Y.

Aeronautical personnel: N. K. B. Patch.

Aeronautical products: Valve seats(aluminum, bronze and stainless steel). Castings.

M

MACWHYTE COMPANY, Kenosha, Wisc.

Aeronautical personnel: Jessel S. Whyte, vice-president and general manager; R. G. Diehl, aeronautical sales and engineering.

Aeronautical products: Tie rods (streamline; round drawn; square drawn). Cable (flexible and non-flexible). Steel hardware (safe lock terminals; clevis pins; rigid terminals; hexagon lock nuts). Wire rope.

MARLIN-ROCKWELL CORP., Jamestown, N. Y.

Factories: Jamestown, N. Y.; Plainville, Conn.

Branch offices: 40 W. 63 St., New York, N. Y.; 5046 Cass Ave., Detroit, Mich.; 2526 S. Michigan Ave., Chicago, Ill.

Aeronautical personnel: A. C. Davis, vice-president and general manager; H. A. Johnson, sales manager; B. J. Shallow, New York district sales representative.

Aeronautical products: Ball bearings (sealed; narrow width; super-precision).

MARQUETTE METAL PRODUCTS CO.,
1145 Galewood Drive, Cleveland, Ohio

Aeronautical personnel: J. S. Kustin.

Aeronautical products: Piston pins. Link pins. Nuts and bolts.

MEISEL PRESS MANUFACTURING CO.,
950 Dorchester Ave., Boston, Mass.

Aeronautical personnel: S. A. Smith.

Aeronautical products: Gears. Sprockets.

McCORD RADIATOR & MFG. CO.,
Detroit, Michigan

Aeronautical personnel: E. O. Bodkin.

Aeronautical products: Gaskets.

McGILL MANUFACTURING CO.,
Valparaiso, Ind.

Aeronautical personnel: Chas. S. McGill, vice-president; W. E. Brownell, general manager; T. L. Robinson, aeronautical engineer.

Aeronautical products: Ball bearings (*Multirol* full-type roller).

McPHERSON FOUNDRY CO.,
1218 Elati, Denver, Colo.

Aeronautical products: Castings (aluminum).

McQUAY-NORRIS MFG. CO.,
Cooper & Southwest Aves., St. Louis, Mo.

Aeronautical personnel: A. J. Mummert; J. V. Cassani.

Aeronautical products: Piston pins.

W. MEGIN LUMBER CO., Naugatuck, Conn.

Aeronautical products: Pine. Maple. White wood.

MERRIMAC CHEMICAL CO., Boston, Mass.

Aeronautical personnel: Dr. L. A. Pratt, director of sales; Dr. H. L. Whalen, research; Albert W. Dunning, salesman for aeronautical products.

Aeronautical products: Acetate fire resistant finishes. Dope. Thinner. Lacquer. Surfacer. Primer. Synthetics.

METAL & ALLOY SPECIALTY CO.,
1875 Elmwood Ave., Buffalo, N. Y.

Aeronautical personnel: T. S. Hennenway.

Aeronautical products: Castings.

METAL GOODS CORPORATION,
2408 N. 10th St., St. Louis, Mo.

Aeronautical products: Aluminum (rivets and tubing).

MICHIGAN SEAMLESS TUBE CO.,
South Lyon, Michigan

Aeronautical products: Tubing (steel).

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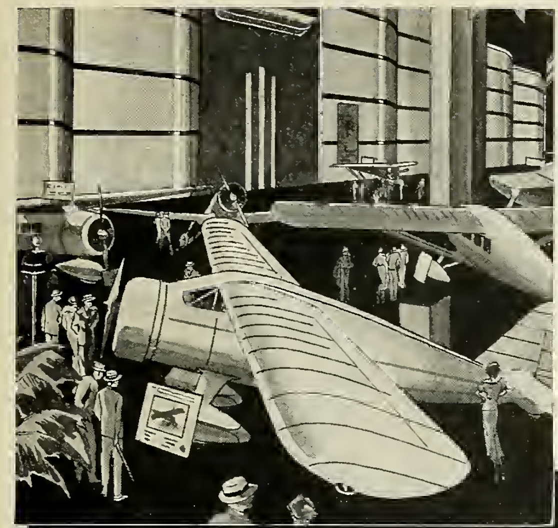


AMERICA'S GREAT *Pageant* OF AERONAUTICAL PROGRESS

As the date of the All-American Aircraft Show draws nearer, there is every indication that this show will be a true pageant of aeronautical progress.

Manufacturers of planes, engines, propellers, accessories and supplies, alive to the need of showing their advanced products, are daily evincing greater enthusiasm.

Matching their interest is the keen desire of the private plane owner, sportsman pilot and business executive to see grouped together a 1935 showing of aviation's newest and greatest achievements.

The aircraft industry sees in this show an opportunity to feel the pulse of aeronautics in the most definite and direct way possible. Proof of this is the fact that 5 weeks before the show 60% of the available space had been assigned.

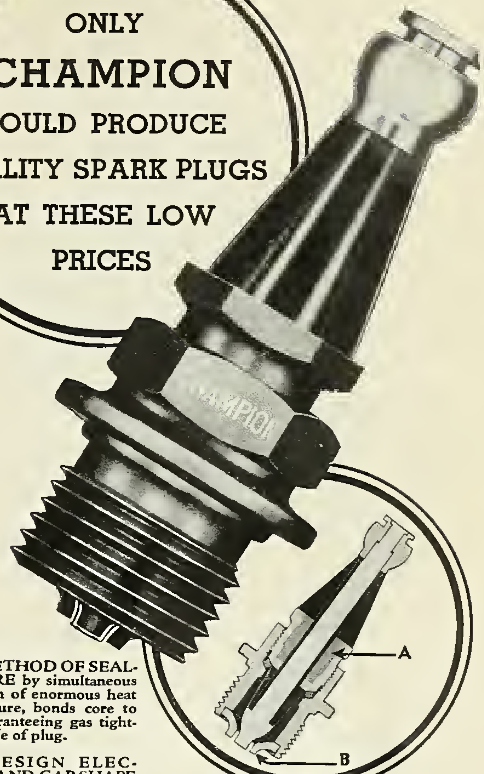
Join this aviation jubilee, the industry's greatest 1935 round-up.

Sponsored by the Aeronautical Activities Association, of Michigan; Sanctioned by the Aeronautical Chamber of Commerce of America.

RAY COOPER, *Manager* DETROIT CITY AIRPORT

ALL-AMERICAN AIRCRAFT SHOW
DETROIT—JULY 20 to 28th INCLUSIVE

ONLY CHAMPION COULD PRODUCE QUALITY SPARK PLUGS AT THESE LOW PRICES



A NEW METHOD OF SEALING CORE by simultaneous application of enormous heat and pressure, bonds core to shell, guaranteeing gas tightness for life of plug.

B NEW DESIGN ELECTRODE AND GAP SHAPE with large area of parallel sparking surfaces increases plug life and means less frequent gap-setting.

CHAMPION
Mica Aircraft Spark Plugs
Now $1.50 to $1.75 Each

The Mica Aircraft Spark Plugs built by Champion, backed by Champion's 25-year reputation and experience, incorporating the exclusive Champion structural features and produced in Champion's modern plants, are exceptional in performance and dependability. Their low prices are the result of large scale production by the world's largest manufacturers of spark plugs of all kinds.

Champion Mica Aircraft Spark Plugs have been developed through extensive testing and research. Their reliability and long life are already proven facts. Approved by leading engine makers and used by the U. S. Army Air Corps.

Champion M-3-1 Mica Aircraft Plug 18 mm, 11/16" hex with *improved* 4 point gap setting. Price $1.75
Champion M-3 Mica Aircraft Plug—18 mm, 11/16" hex—same as M-3-1 except with standard 4 point gap set. Price $1.50

VISIT CHAMPION EXHIBIT AT ALL-AMERICAN AIRCRAFT SHOW • DETROIT, JULY 20-28.

Manufacturers of Fabricated Parts and Aircraft Materials (continued)

MILFORD RIVET & MACHINE CO.,
Milford, Conn.

Aeronautical products: Nuts and bolts.

MILLER & VAN WINKLE,
18 Bridge St., Brooklyn, N. Y.

Aeronautical personnel: E. Miller.

Aeronautical products: Springs.

MOHAWK CARPET MILLS,
295 Fifth Ave., New York, N. Y.

Factory: Amsterdam, N. Y.

Aeronautical personnel: (Amsterdam) Arthur W. Shuttleworth, president and general manager; Howard L. Shuttleworth, vice-president and treasurer.

Aeronautical personnel: (New York City) Victor Bowman, general sales manager; Ted E. Brown, assistant general sales manager; E. Gerry Tuttle, advertising manager.

Aeronautical products: Carpets.

MOLDED INSULATION COMPANY,
3246 Ludlow St., Philadelphia, Pa.

Aeronautical personnel: V. I. Zelov, president; M. K. Goldstein, research engineer.

Aeronautical products: Pulleys (control). Radio accessories. Bakelite molded parts and assemblies.

MOTOR CASTING CO., Milwaukee, Wisc.

Aeronautical products: Castings (steel).

MURPHY VARNISH CO., Newark, N. J.

Aeronautical personnel: C. J. Roh, president.

Aeronautical products: Varnish. Enamels. Lacquer.

MUSKEGON SPECIALTIES CO.,
Muskegon, Mich.

Factories: Muskegon, and Jackson, Mich.

Aeronautical products: Camshafts. Crankshafts.

N

NATIONAL FORGE & ORDNANCE COMPANY,
Irvine, Pennsylvania

Branch offices: New York, N. Y.; Philadelphia, Pa.; Pittsburgh, Pa.; Chicago, Ill.; Cleveland, O.; Detroit, Mich.; St. Louis, Mo.; Washington, D. C.

Aeronautical personnel: J. C. Harrington, assistant manager.

Aeronautical products: Forgings (propeller hubs).

NATIONAL TUBE CO.,
Pittsburgh, Pennsylvania

Aeronautical products: Tubing (steel). Exhaust stacks.

NATIONAL VULCANIZED FIBRE COMPANY,
Wilmington, Delaware

Branch offices: 36 Pleasant St., Watertown, Mass.; 30 Church St., New York, N. Y.; Girard Trust Bldg., Philadelphia, Pa.; 15 E. Saratoga St., Baltimore, Md.; National Bldg., Cleveland, O.; Oliver Bldg., Pittsburgh, Pa.; 2219 5th Ave., S., Birmingham, Ala.; Kresge Bldg., Detroit, Mich.; 2808 W. Lake St., Chicago, Ill.; 4903 Delmar Blvd., St. Louis, Mo.; Powers Bldg., Rochester, N. Y.; Dayton Industries Bldg., Dayton, O.; 626 Broadway, Cincinnati, O.; P. O. Box 33, Bluefield, W. Va.; Plymouth Bldg., New Haven, Conn.; 107 Atlantic Ave., Toronto, Canada; Builders Bldg., Charlotte, N. C.; 1715 California St., Denver, Colo.; National Insulations Co., 342 N. Water St., Milwaukee, Wisc.; F. J. Klenck Co., 311 Minna St., San Francisco, Calif.; 451 E. 3rd St., Los Angeles, Calif.; 305 NW 12 St., Portland, Ore.; 2737 First Ave. S., Seattle, Wash.; Hutton Bldg., Spokane, Wash.

Aeronautical personnel: H. C. Hackett, sales manager (Wilmington); J. W. Brownville (Watertown); W. B. Cosgrave (New York); T. B. Baldridge (Philadelphia); J. V. Brooks (Baltimore); R. S. Fisher (Cleveland); E. W. Wessel (Pittsburgh); W. H. Beaven (Birmingham); R. O. Wire (Detroit); G. W. Glaescher (Chicago); G. C. Reynolds (St. Louis); H. A. Beach (Rochester); C. E. Drury (Dayton); R. F. Bauer (Cincinnati); J. R. Cameron (Bluefield); J. H. Alcorn (New Haven); F. J. Klenck (San Francisco); Geo. Hamburger (Denver); H. A. Frankel (Toronto); R. G. Henderson (Charlotte, N. C.); R. L. Miller (Milwaukee).

Aeronautical products: Fibre (sheet; tube; rod; fabricated shapes). Gears and pinions *Phenolite* (laminated bakelite sheet; tube; rod).

J. W. NELSON COMPANY,
1935 Ash St., Detroit, Mich.

Aeronautical products: Crankshafts. Camshafts.

NEW DEPARTURE MFG. Co., Bristol, Conn.

Aeronautical personnel: DeWitt Page, president; H. W. Oldsworth.

Aeronautical products: Bearings (steel).

NIAGARA ASBESTOS CO., Buffalo, N. Y.

Aeronautical products: Asbestos.

NORMA-HOFFMANN BEARINGS CORP.
Stamford, Connecticut.

Branch offices: 155 E. 44 St., New York, N. Y.; 310 S. Michigan Ave., Chicago, Ill.; 1841 Plaza, Charlotte, N. C.; Hanna Bldg., Cleveland, O.; 105 Fahnestock Rd., Pittsburgh, Pa.; Eaton Tower, Detroit, Mich. Associated companies: Ahlberg Bearing Co. of Calif., Inc., 1708 S. Grand Ave., Los Angeles, Calif.; John A. Masterson & Co., 1706 S. Grand Ave., Los Angeles, Calif.; Irvin Silverberg & Co., 520 Van Ness Ave., San Francisco. Calif.

Aeronautical personnel: W. M. Nones, president; O. P. Wilson, vice-president; H. J. Ritter, sales manager; C. B. Malone, factory manager; G. R. Bott, engineering manager; F. Wright, research engineer.

Aeronautical products: Ball bearings (double metal seal and extra light single row; single row with and without metal seal; *GreaSeal* felt-protected single row; double row self-aligning; open type single row). Precision ball bearings (extra light closed type; angular contact; separable; one-lipped separable; two-lipped non-separable; full roller retainerless; extra light separable). Thrust bearings (single direction; extra light single direction, double direction). Stainless steel bearings. Cadmium plated bearings. Pin bearings. Needle bearings.

NORTH BERGEN PAINT & VARNISH CO.
North Bergen, New Jersey

Aeronautical products: Paint.

O

OHIO CRANKSHAFT CO.,
6600 Clement Ave., Cleveland, Ohio

Aeronautical personnel: W. C. Dunn, president.

Aeronautical products: Crankshafts.

THE OHIO PISTON CO., Cleveland, Ohio

Aeronautical personnel: D. P. Shaw, manager.

Aeronautical products: Pistons. Piston pins. Cylinder sleeves.

OHIO RUBBER CO., Willoughby, Ohio

Aeronautical products: Rubber parts.

THE OHIO SEAMLESS TUBE CO., Shelby, O.

Branch offices: 2857 E. Grand Blvd., Detroit, Mich.; 70 E. 45th St., New York, N. Y.; Citizens Bldg., Cleveland, O.; 1225 W. Washington Blvd., Chicago, Ill. Eastern representative: Joseph T. Ryerson & Son, Inc., Jersey City, N. J.; Philadelphia, Pa.; Boston, Mass.

Aeronautical personnel: C. H. Wood, vice-president in charge of sales.

Aeronautical products: Tubing (cold drawn seamless steel).

OKLAHOMA STEEL CASTINGS CO.,
Tulsa, Oklahoma

Aeronautical products: Castings (steel).

P

PACKARD ELECTRIC CORP., Warren, Ohio
Aeronautical personnel: B. N. MacGregor, vice-president and general manager; G. S. Carr, sales manager of the equipment division; R. J. Montgomery. manager, replacement division; L. C. Wolcott, chief engineer.

(*Continued on following pages*)

New Rearwin Sportster, Model 7000, A.T.C. 574

Another Rearwin Triumph!

THE Rearwin "Sportster" is designed to meet a real demand—not just a price. Classy, Sporty lines—a beautiful model with all refinements looked for in a much higher priced airplane. Dual controls. Commodious, comfortable cabin. Perfect visibility. 24-gallon gas tanks in wings. Hydraulic landing gear. 70 H.P. LeBlond Motor—all reserve power needed. Fly for a cent a mile! Ideally adapted for student training, sport flying, long trips, etc. Many features make the Rearwin an outstanding advance in Airplane Industry.

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GET THE BEST...

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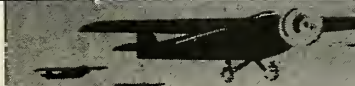
Major "Al" Williams, Lecturer and advanced flying instructor.

Hugh Copeland, Transport Pilot and Chief Ground and Mechanics Instructor.



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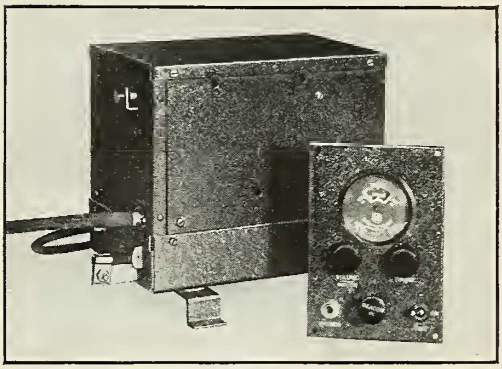

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RCA Receiver Models AVR-7, 7A

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AVT-3A AIRCRAFT TRANSMITTER

Made to the same strict high-quality specifications. Complete in a single unit including dynamotor power supply. Operates on any three pre-specified frequencies (selective in flight), between 2000 and 6500 kilocycles. Power, 20 watts. Permits transmission on CW, modulated CW, and 100% modulated telephony.

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RCA MANUFACTURING COMPANY, INC.
CAMDEN NEW JERSEY

Aeronautical products: Electric cable (shielded and unshielded high tension; lighting; two conductor; combination single- and two-conductor; landing light; starter and power). Braided sleeving.

THE PALNUT CO., Irvington, New Jersey

Aeronautical personnel: J. R. Hotchkin, president; A. H. Beggs, sales manager.

Aeronautical products: Locknut (*Palnut* spring steel, cadmium finish).

PANTOSOTE COMPANY, INC.,
250 Park Ave., New York, N. Y.

Aeronautical personnel: E. H. Outerbridge, president.

Aeronautical products: Upholstery fabric. (imitation leather).

THE PARK DROP FORGE CO., Cleveland, O.

Aeronautical personnel: Geo. C. Gordon, president.

Aeronautical products: Forgings (crankshaft; connecting rod; camshaft; gear; propeller hub; master rod). Finished products (crankshafts; camshafts).

PARKER APPLIANCE COMPANY,
10320 Berea Rd., Cleveland, O.

Aeronautical personnel: A. L. Parker.

Aeronautical products: Valves. Fittings. Pumps. Shut-off cocks. Fuel line tubing.

PARKER-KALON CORP., New York, N. Y.

Aeronautical personnel: S. Kahn.

Aeronautical products: Nuts and bolts.

E. PAXTON LUMBER CO., Kansas City, Kan.

Aeronautical personnel: F. Paxton.
Aeronautical products: Spruce.

PECO MANUFACTURING COMPANY,
Hope St. & Indiana Ave., Philadelphia, Pa.

Aeronautical personnel: P. E. Moss.

Aeronautical products: Stampings.

PENN RIVET COMPANY,
3d and Huntingdon Sts., Philadelphia, Pa.

Aeronautical personnel: J. Clement.

Aeronautical products: Rivets.

PERFECT CIRCLE COMPANY,
2241 S. Washington, Hagerstown, Ind.

Aeronautical personnel: George Stout.

Aeronautical products: Piston Rings.

PERRY-AUSTIN MANUFACTURING CO.
Grasmere, Staten Island, N. Y.

Aeronautical personnel: F. T. Perry.

Aeronautical products: Dopes (pigmented and clear). Thinner. Lacquer. Paint.

PHILLIPS BRONZE BUSHING WORKS,
Los Angeles, Calif.

Aeronautical products: Castings (bronze).

PHILPOTT RUBBER COMPANY,
1381 W. Third St., Cleveland, O.

Aeronautical products: Rubber parts.

PHOSPHOR BRONZE SMELTING CO.,
2202 Washington Ave., Philadelphia, Pa.

Aeronautical products: Phosphor bronze (sheet).

THE PIKE-DIAL LUMBER COMPANY,
2251 S. Loomis St., Chicago, Illinois

Aeronautical personnel: W. T. Osgood.

Aeronautical products: Sitka spruce (rough; cut to dimensions).

PITTSBURGH PLATE GLASS COMPANY
Grand Bldg., Pittsburgh, Pa.

Factories: (Paint and Varnish Division) Milwaukee, Wis.; Newark, N. J.; Portland, Ore.; Los Angeles, Calif. (Ditzler Color Division) Detroit, Mich.

Branch offices: 235 E. Pittsburgh Ave., Milwaukee, Wis.; Newark, N. J.; Portland, Ore.; Los Angeles, Calif.; Detroit, Mich.

Aeronautical personnel: L. F. Theurer, in charge of aeronautical sales; P. R. Croll, director of research (Milwaukee); F. L. Theurer, manager of production.

Aeronautical products: Paint and dope (heat resistant aluminum liquid; standard Army color oil base enamel; black engine enamel; acid proof black enamel). Dope (*Mimax* thinner; sealer). Varnish (clear aircraft). Lacquer (*Mimax*). Windshield and enclosure material. Cabin glass.

PLOMB TOOL COMPANY,
2209 Sante Fe Ave., Los Angeles, Calif.

Aeronautical products: Springs.

POLLAK MANUFACTURING CO.,
Arlington, New Jersey

Aeronautical products: Collector rings.

POSEY MANUFACTURING CO.,
Hoquiam, Wash.

Aeronautical personnel: J. V. G. Posey.

Aeronautical products: Spruce.

HORACE T. POTTS,
Erie & D Sts., Philadelphia, Pa.

Aeronautical personnel: Thomas C. Potts.

Aeronautical products: Steel (forgings and bushings).

PRATT & LAMBERT, INCORPORATED,
73 Tonawanda St., Buffalo, N. Y.

Branch offices: Chicago, Ill.; New York, N. Y.; Fort Erie, Ontario, Canada.

Aeronautical personnel: T. E. Murphy, manager industrial sales.

Aeronautical products: Paint (enamel; primer). Dope. Varnish, Lacquer.

PREMIER BRONZE CORPORATION
1022 N. Sixth St., St. Louis, Mo.

Aeronautical personnel: Hade Rubelmann, president.

Aeronautical products: Bearing bronze (bushing, cored and solid bars; casting; babbitt; rebabbitting). Cast iron and aluminum solder. Gear bronze.

PROTECTO SAFETY GLASS CORPORATION,
Glendale, Long Island, New York

Aeronautical personnel: Murray Friedman, president.

Aeronautical products: Safety glass.

R

RADEL LEATHER CO., Newark, N. J.

Aeronautical personnel: R. H. Cudlipp.

Aeronautical products: Upholstery (leather).

RAILWAY STEEL SPRING CO.,
30 Church St., New York, N. Y.

Aeronautical products: Springs.

RANDOLPH FINISHING PRODUCTS CO.,
Teterboro Airport, Hasbrouck Heights, N. J.

Aeronautical personnel: W. G. Randolph.

Aeronautical products: Lacquer. Synthetic products. Special finishes. Dope (nitrate; acetate).

THE MANHATTAN RUBBER MFG., DIV.,
(of Raybestos-Manhattan, Inc.)
61 Willett St., Passaic, New Jersey.

Factories: Passaic, N. J.; Nennah, Wis.; Whippany, N. J.

Branch offices: 1108 N. Fifth Ave., Birmingham, Ala.; 10 High St., Boston, Mass.; 445 Lake Shore Drive, Chicago, Ill.; Fisher Bldg., Detroit, Mich.; 404 Washington Ave. N., Minneapolis, Minn.; 1007 Camp St., New Orleans, La.; 120 Broadway, New York, N. Y.; Broad Street Station Bldg., Philadelphia, Pa.; Koppers Bldg., Pittsburgh, Pa.; 1606 Pine St., St. Louis, Mo.

Aeronautical personnel: C. T. Young, factory manager and purchasing agent.

Aeronautical products: Rubber utilities (engine mountings; control stick grips; fuel tank insulation; moulded rubber). Gaskets (oil proof). Airproof refueling hose.

RAYMOND MFG. COMPANY,
Corry, Pennsylvania.

Aeronautical personnel: F. M. Raymond, president; F. E. Whittlesey, secretary-

(*Continued on following pages*)

WORLD LEADERS IN SEAPLANE EQUIPMENT

EDO is preeminent in the design and construction of modern all-metal Floats for the airplanes of the world. In confirmation of this, over 130 different types of transport, military and private airplanes use EDO Floats — interchangeable with land gear — for water flying. Complete data will be gladly sent on request. Address: EDO Aircraft Corporation, 610 Second Street, College Point, Long Island, New York.

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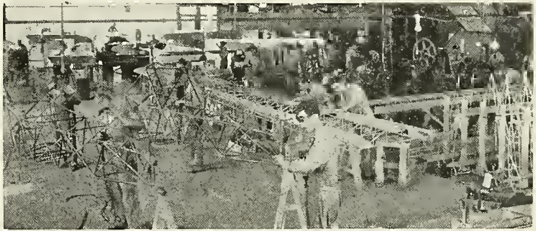

Corner of the Taylor Aircraft factory at Bradford, Pennsylvania.

60 "CUBS" bought in May and June

$1425
With Continental A40-3 Motor
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The Taylor "CUB" is the biggest airplane value in America today because it's a soundly engineered airplane in every respect. Expert fliers with thousands of hours and novices alike are enthusiastic about the "CUB." That's why so many are bought.

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A new folder now ready. It's yours for the asking.

NEW TIME PAYMENT PLAN More liberal terms. Makes the CUB easier to buy. Write for details.

TAYLOR AIRCRAFT CO.
BRADFORD - - - - PENNSYLVANIA

treasurer; J. E. Mount, sales manager.

Aeronautical products: Springs (valve; wire forms for parachutes and aircraft). Stampings. Manufactured to specifications.

RELIABLE PATTERN CO., Cincinnati, O.

Aeronautical products: Castings.

REPUBLIC STEEL CORP., Massillon, O.

Factories: Beaver Falls, and Pittsburgh, Pa.; Birmingham, Ala.; Brooklyn, and Buffalo, N. Y.; Canton, Cleveland, Elyria, Massillon, Niles, Warren, and Youngstown, Ohio; Chicago and Moline, Ill.; East Chicago, Gary and Muncie, Ind.; Detroit, Mich.; Hartford, Conn.; Hamilton, Ontario, Canada.

Branch offices: Empire Bldg., Birmingham, Ala.; Liberty Bank Bldg., Buffalo, N. Y.; Carew Tower, Cincinnati, O.; Continental Oil Bldg., Denver, Colo.; Grand Rapids Trust Bldg., Grand Rapids, Mich.; Circle Tower, Indianapolis, Ind.; Chrysler Bldg., New York, N. Y.; Broad St. Station Bldg., Philadelphia, Pa.; Atlas Bldg., Salt Lake City, Utah; First National Bank Bldg., St. Paul, Minn.; White-Henry-Stuart Bldg., Seattle, Wash.; Thompson Bldg., Tulsa, Okla.; 250 Stuart St., Boston, Mass.; McCormick Bldg., Chicago, Ill.; Union Trust Bldg., Cleveland, O.; Fisher Bldg., Detroit, Mich.; Gulf Bldg., Houston, Tex.; California Edison Bldg., Los Angeles, Calif.; First Wisconsin National Bank Bldg., Milwaukee, Wisc.; 4th & Bingham Sts., Pittsburgh, Pa.; Paul Brown Bldg., St. Louis, Mo.; Ohio Bank Bldg., Toledo, O.; Republic Bldg., Youngstown, O. General Export Department: Chrysler Bldg., New York, N. Y.

Aeronautical personnel: (Cleveland) T. M. Girdler, president and chairman of the board; Myron A. Wick, vice-president. (Youngstown) B. F. Fairless, first vice-president; N. J. Clarke, vice-president in charge of sales; A. E. Walker, general manager of sales; S. A. Knisely, advertising and sales promotion manager. (Massillon) J. M. Schlendorf, manager of sales.

Aeronautical products: Steel tubing (SAE X-4130). Steel (SAE 4140; SAE 6135; Chrome-nickel-molybdenum; 5% nickel; SAE 2340 & Cr-Ni-Mo; SAE 3240 modified; SAE 4140; SAE 3312; SAE 3145; SAE 6150; Nitralloy; 18-8).

RHODE ISLAND TOOL CO., Providence, R. I.

Aeronautical products: Nuts and bolts.

RICH TOOL COMPANY,
513 Railway Exchange, Chicago, Ill.

Aeronautical products: Valves.

RINSHED MASON CO., Detroit, Mich.

Aeronautical products: Lacquer.

C. A. ROBERTS COMPANY, Detroit, Mich.

Aeronautical products: Tubing (copper).

ROBERTS TUBE WORKS,
2500 Military Ave., Detroit, Mich.

Aeronautical products: Fuel line tubing.

RODDIS LUMBER & VENEER COMPANY,
402 Elm St., Dallas, Texas

Aeronautical products: Plywood.

JOHN A. ROEBLING'S SONS CO., Trenton, N. J.

Factories: Trenton and Roebling, N. J.

Branch offices: 107 Liberty St., New York, N. Y.; 51 Sleeper St., Boston, Mass.; 205 W. Wacker Drive, Chicago, Ill.; 223 Arch St., Philadelphia, Pa.; 701 St. Claire Ave., N.E., Cleveland, O., 934 Avon Ave., Atlanta, Ga. John A. Roebling's Sons Co. of California; 624 Folsom St., San Francisco, Calif.; 216 S. Alameda St., Los Angeles, Calif.; 1032 N.W. 14 Ave., Portland, Ore.; 900 First Ave., S., Seattle, Wash.

Aeronautical personnel: Horace E. Thorn.

Aeronautical products: Wire and wire rope (standard tinned, galvanized strand, galvanized cotton or wire center cord). Insulated wire. Insulated cable (high tension ignition, shielded and unshielded for power and lighting circuits, single and two-conductor braided or shielded, single and two-conductor shielded tinned copper braid power and lighting circuit). Galvanized steel thimbles. Steel ferrules. Wire rope fittings and slings. Electric or gas welding wire. Serving and locking wire. Balloon cable. Wire (brass, copper and steel). Control casing, cord and strand.

RUBATEX PRODUCTS, INCORPORATED
277 Park Ave., New York, N. Y.

Factory: Bedford, Va.

Aeronautical personnel: Dudley Roberts, president; Fred W. Peel, vice-president and general manager; S. E. Kienitz.

Aeronautical products: Rubber utilities (*Rubatex* soundproofing; insulation; gaskets).

RUBBERCRAFT CORP. OF CALIFORNIA, LTD.
110 E. 17th St., Los Angeles, Calif.

Factory: Torrance, California.
Aeronautical personnel: Charles N. Merralls, president; G. K. Norton, and J. H. Purnell, in charge of aeronautical sales; R. H. Newell production manager; Fred King, research manager; F. N. Merralls, manager of general research.

Aeronautical products: Rubber utilities (cups; washers; gaskets; skid wheels; crash pads; plugs; tail wheels; terminals; channel; grommets; bumpers; bushings; rings; belts; shock absorbers; discs; strips; frames; spacers).

D. J. RYAN FOUNDRY, Ecorse, Mich.

Aeronautical products: Castings (steel).

JOSEPH T. RYERSON & SON, INC.,
16th & Rockwell Sts., Chicago, Illinois

Branch offices: Exchange Bldg., Kansas City, Mo.; Manufacturers' National Bank Bldg., Rockford, Ill.; 605 Washington Ave. N., Minneapolis, Minn.; 2035 E. 11 St., Tulsa, Okla.; State Bank Bldg., Rock Island, Ill.

Service plants: 320 S. 19th St., Milwaukee, Wisc.; 5 Clinton St., St. Louis, Mo.; 1600 E. Euclid Ave., Detroit, Mich.; Front & Freeman Sts., Cincinnati, O.; East 53 & Lakeside Ave., Cleveland, O.; 203 Westside Ave., Jersey City, N. J.; 5200 Grays Ave., Philadelphia, Pa.; Bailey Ave. & Stanley St., Buffalo, N. Y.; Third, Binney & Munroe Sts., Cambridge, Mass.

Aeronautical products: Steel (cold rolled strip; shim; aircraft strip; 18-8 stainless sheet; 18-8 plate; 18-8 tube; bar; round, cold drawn, hexagon, square). Steel alloys (chrome nickel bar; round). Tubing (seamless). Hardware.

S

SANFORD MILLS, Sanford, Maine

Aeronautical products: Carpets.

SAFETEE GLASS COMPANY,
Wayne Junction, Philadelphia, Pa.

Aeronautical personnel: C. A. McCusker, manager of sales and purchases.

Aeronautical products: Glass (non-shatterable; sound insulating; welding and goggle lenses).

SAYLOR ELECTRIC & MANUFACTURING CO.,
1014 Lynn Ave., Detroit, Mich.

Aeronautical personnel: J. M. Sharkey.

Aeronautical products: Insulation material.

F. SCHUMACHER & COMPANY,
60 W. 40th St., New York, N. Y.

Aeronautical personnel: W. N. Lee.

Aeronautical products: Upholstery (fabric). Drapery. Carpet.

SCINTILLA MAGNETO COMPANY, INC.
Sherman Ave., Sydney, New York

Branch office: 230 Park Ave., New York, N. Y.

Aeronautical personnel: Vincent Bendix, president; H. Hanni, vice-president and general manager; T. Z. Fagan, vice-president in charge of sales; W. J. Spengler, chief engineer.

Aeronautical products: Magnetos. Shielding. Battery ignition timers. Battery ignition coils. Switches. Spark plugs.

(*Continued on following pages*)

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1st Manufacturer to enter the light plane field. Continuous operation since 1930.

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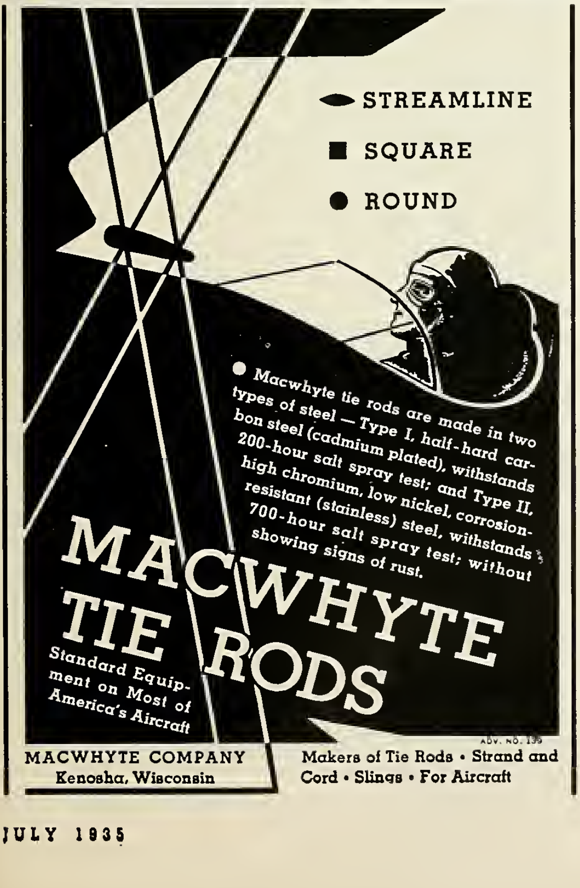

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● Macwhyte tie rods are made in two types of steel — Type I, half-hard carbon steel (cadmium plated), withstands 200-hour salt spray test; and Type II, high chromium, low nickel, corrosion-resistant (stainless) steel, withstands 700-hour salt spray test; without showing signs of rust.

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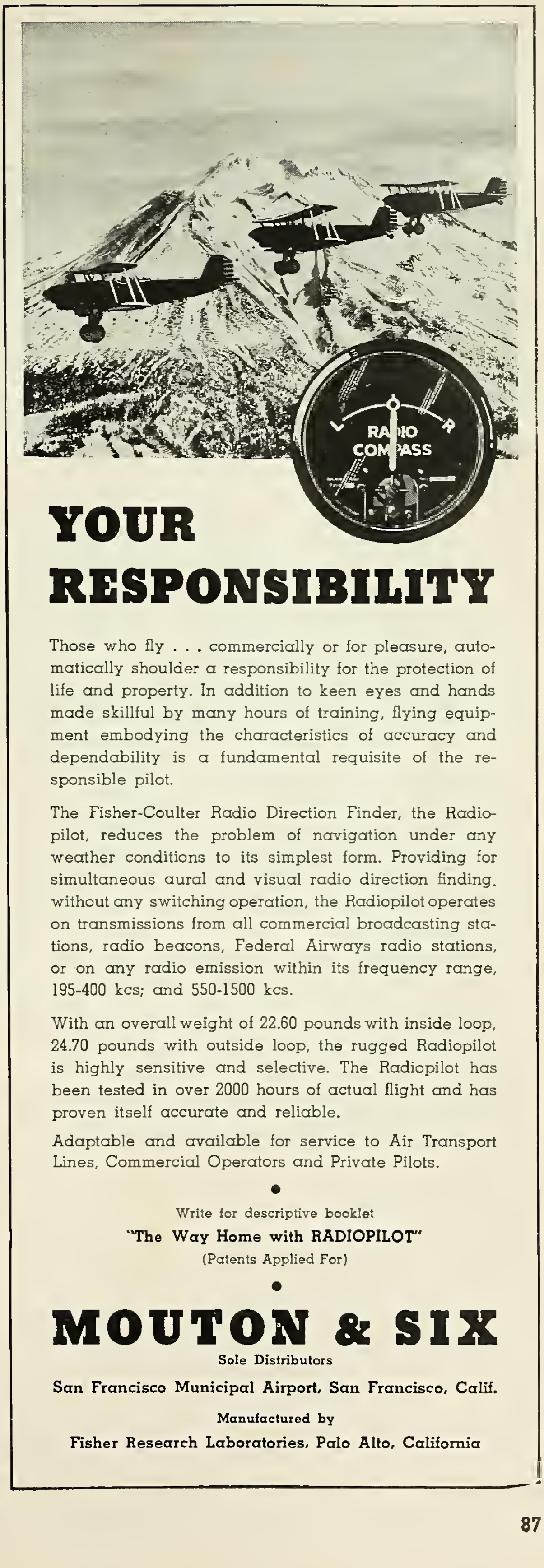

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Those who fly . . . commercially or for pleasure, automatically shoulder a responsibility for the protection of life and property. In addition to keen eyes and hands made skillful by many hours of training, flying equipment embodying the characteristics of accuracy and dependability is a fundamental requisite of the responsible pilot.

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With an overall weight of 22.60 pounds with inside loop, 24.70 pounds with outside loop, the rugged Radiopilot is highly sensitive and selective. The Radiopilot has been tested in over 2000 hours of actual flight and has proven itself accurate and reliable.

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SCULLY STEEL PRODUCTS CO.,
21st & Gratiot Sts., St. Louis, Mo.

Aeronautical products: Steel (bar).

SEABOARD BRASS & COPPER CO.
35 S. Gay St., Baltimore, Md.

Aeronautical products: Brass (sheet, tube and wire).

SEALED POWER CORP., Muskegon, Mich.

Branch offices or warehouses: 326 Ivy St., Atlanta, Ga., c/o Jobbers Service; 2620 S. Michigan Ave., Chicago, Ill., c/o Automotive Warehousing Corp.; 2857 Forsythe Ave., Detroit, Mich., c/o Jobbers Warehouse; 1358 S. Flower St., Los Angeles, Calif., c/o Sydney H. Russell, Inc.; 9-11 Jersey St., Boston, Mass.; 2717 Main St., Dallas, Tex., c/o Parts Warehouse Co.; 14 & Oak Sts., Kansas City, Mo., c/o R. O. Smith Motor Parts Warehouse; 1612 Harmon Pl., Minneapolis, Minn., c/o Automotive Warehouse; 249 W. 64 St., New York, N. Y., c/o Auto Parts Warehousing Co.; 408 N. W. 12 Ave., Portland, Ore., c/o Automotive Warehouse Co.; 809 North 19 St., Philadelphia, Pa., c/o Automotive Parts Warehousing Co.; 552 McAllister St., San Francisco, Calif. Canadian Representative: A. H. Fraser & Co., Ltd., 283 King St., E. Toronto, Ont.

Aeronautical personnel: N. A. Moore, research and production; W. J. Sheldon, service sales.

Aeronautical products: Pistons. Piston pins. Piston rings.

SEAMAN PAPER CO., Chicago, Ill.

Aeronautical personnel: George Seaman.

Aeronautical products: (*Seapak*) Soundproofing and insulation material.

SEAMLEX CORPORATION
5-19 48th Avenue, Long Island City, N. Y.

Aeronautical personnel: Frank F. Jacobson, president; C. K. Freeman, director of sales.

Aeronautical products: Flexible tubing (*Seamless* oil and fuel lines, bronze, aluminum or monel to absorb vibration, expansion, or flexing). Shielding (flexible aluminum conduit for electrical wiring systems).

A. G. SEAVER, Denver Colo.

Aeronautical products: Upholstery (leather and fabric).

SEIBERT VARNISH COMPANY
6455 Strong, Detroit, Mich.

Aeronautical products: Paint. Enamel.

SEWALL PAINT & VARNISH COMPANY
Kansas City, Mo.

Aeronautical products: Paint.

SHENANGO-PENN MOLDING CO.,
Oliver Bldg., Pittsburgh, Pa.

Aeronautical personnel: G. L. Collord, vice-president.

Aeronautical products: Valve guides.

SERVICE STEEL COMPANY,
1435 Franklin St., Detroit, Mich.

Factory: Plymouth, Mich.

Branch offices and warehouses: Buffalo, N. Y.; Cincinnati, O.; Los Angeles, Calif.

Aeronautical products: Tubing (seamless brass and copper); rod (brass and copper). Metallic flexible hose.

THE SHERWIN WILLIAMS COMPANY
101 Prospect Ave., N.W., Cleveland, O.

Factories: 115th St., & Cottage Grove, Chicago, Ill.; 601 Canal Road, Cleveland, O.; Brown St. & Lister Ave., Newark, N. J.; 1450 Sherwin Ave., Oakland, Calif.

Branch offices and warehouses: 19 Pittsburgh St., Boston, Mass.; 333 N. Michigan Ave., Chicago, Ill.; 410 Commercial Sq., Cincinnati, O.; 1621 Wall St., Dallas, Tex.; 1960 Milwaukee Ave., E., Detroit, Mich.; 219 N. Senate Ave., Indianapolis, Ind.; 2320 Liberty St., Jacksonville, Fla.; 1520 Grand Ave., Kansas City, Mo.; 701 Third St. N., Minneapolis, Minn.; Cummins Station, Nashville, Tenn.; 741 Magazine St., New Orleans, La.; Delaware & Chestnut Sts., Philadelphia, Pa.; 55 Water St., Pittsburgh, Pa.; 1308 N. W. Everett St., Portland, Ore.; 1315 E. Main St., Richmond, Va.; 1048-6th Ave., S., Seattle, Wash.; 515 Spruce St., St. Louis, Mo.

Warehouses: Colonie & Montgomery Sts., Albany, N. Y.; Pratt & Green Sts., Baltimore, Md.; 56 Post Office Sq., Bangor, Me.; 37 Pearl St., Buffalo, N. Y.; 267 E. Bay St., Charleston, S. C.; 212 W. First St., Charlotte, N. C.; 2108 Preston Ave., Houston, Tex.; 236 W. Jefferson St., Louisville, Ky.; 121 Union Ave., Memphis, Tenn.; 223 E. Grand Ave., Oklahoma City, Okla.; Dodge & 10th Sts., Omaha, Neb.; 512 W. Jackson St., Phoenix, Ariz.; 64 Traverse St., Providence, R. I.; 53 West Broadway, Salt Lake City, Utah; 610 Folsom St., San Francisco, Calif.; 655 E. Liberty St., Savannah, Ga.; 157 S. Post St., Spokane, Wash.; 203 Solar St., Syracuse, N. Y.; 118 So. Cheyenne St., Tulsa, Okla. Offices: 101 Prospect Ave., N. W., Cleveland, O.; 292 Madison Ave., New York, N. Y. Distributor: Nicholas Beazley: Marshall, Mo., Floyd Bennett Field, Brooklyn, N. Y.; 6235 San Fernando Rd., Glendale, Calif.

Aeronautical personnel: (Cleveland) G. A. Menz and R. Kidd, in charge of development of oil and synthetic type aviation finishes; G. H. Robertson, sales manager, aeronautical division. (Chicago) F. H. Lang, and Lou Pereny, lacquer chemists in charge of development on dope and lacquer enamels.

Aeronautical products: Dope (clear; pigmented). Thinner. Paint. Enamel. Varnish. Primer. Lacquer and lacquer softener and remover. Wax. Polishing compound.

SIMPLEX PISTON RING SALES CO.
1966 E. 66 St., Cleveland, Ohio

Branch offices: 1716 So. Grand Ave., Los Angeles, Calif.; 271 W. 69 St., New York, N. Y.; 2816 Commerce St., Dallas, Tex.; 445 King St. W., Toronto, Canada. British licensees: Wellworthy Ltd., Lymington, Hants, England.

Aeronautical personnel: Dean M. Solenberger, president; Fred G. Ferguson, vice-president; J. L. Littleton, manager eastern division; W. J. Phillips, manager mid-western division; W. L. Danner, manager Pacific coast division; R. C. Thompson, chief engineer; Roy T. Parker, service department.

Aeronautical products: Piston rings (*Simplex* and *Simplex* Molium).

SITKA SPRUCE LUMBER CO., LTD.
I W. 1st Ave., Vancouver, B. C., Canada

Aeronautical personnel: J. A. McEachern.

Aeronautical products: Spruce.

SKF INDUSTRIES, INCORPORATED
Front St. & Erie Ave., Philadelphia, Pa.

Factory: (ball manufacturing plant) Atlas Ball Co., Glenwood Ave. & American St., Philadelphia, Pa.

Branch offices: 598 Peachtree St., N. E., Atlanta, Ga.; 10 High St., Boston, Mass.; Genesee Bldg., Buffalo, N. Y.; Johnston Bldg., Charlotte, N. C.; 1242 W. Washington Blvd., Chicago, Ill.; 1017 Main St., Cincinnati, O.; 3912 Carnegie Ave. Cleveland, O.; 210 Jackson St., Dallas, Tex.; 2820 E. Grand Blvd., Detroit, Mich.; 410 Asylum St., Hartford, Conn.; 101 E. 24 St., Kansas City, Mo.; 1114 S. Hope St., Los Angeles, Calif.; Plankinton Bldg., Milwaukee, Wisc., 407 S. Fourth St., Minneapolis, Minn.; 1976 Broadway, New York, N. Y.; Glenwood Ave. & 4th St., Philadelphia, Pa.; Grant Bldg., Pittsburgh, Pa.; 209 S. W. 9th Ave., Portland, Ore.; 221 Eleventh St., San Francisco, Calif.

Aeronautical personnel: W. L. Batt, president; R. F. Runge, vice-president; R. H. DeMott, general sales manager; J. W. Tawresey, assistant chief engineer; Dr. H. Styri, in charge of research laboratory; N. Miller (Atlanta); H. A. Fonda (Boston); H. G. Wallace (Buffalo); R. W. Franklin (Charlotte); J. B. Castino (Chicago); R. R. Zisette (Cincinnati); P. R. Payson (Cleveland); H. L. Gaddis (Dallas); C. R. Mabley (Detroit); W. C. Clingan (Hartford); H. A. Westwater (Kansas City); C. F. Stein (Milwaukee); A. J. Kishkunas (Minneapolis); J. D. Williamson (New York); M. Middleton (Philadelphia); V. A. Menaglia (Pittsburgh).

Aeronautical products: Bearings (ball; single row deep groove, self-aligning; roller; control pulley).

(*Continued on following pages*)

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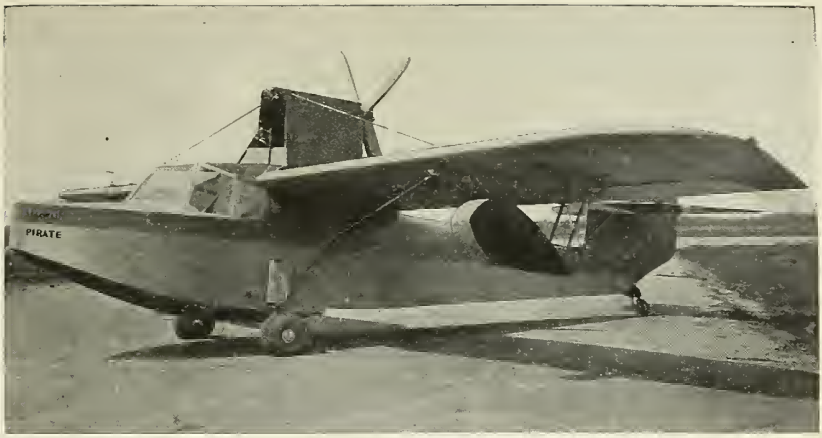

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3-place cabin flying boat type, pusher Amphibian (Menasco C4 PIRATE Engine, 125 H.P.). Span 35 ft. 4 in.; length 26 ft.; height overall 8 ft. 2 in.

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Maximum speed	120 MPH
Cruising speed	104 MPH
Landing speed	40 MPH
Rate of climb	1000 ft. per min.
Service ceiling	15,000 ft.
Gross wt., fully loaded,	1870 lbs.
Gasoline, 40 gallons	240 lbs.
Payload (in place of 2 passengers plus 100 lbs. baggage)	440 lbs.

Standard equipment includes starter, cabin heater, brakes, anchor, navigation lights; wobble pump, engine-driven fuel pump. Instruments: airspeed, compass, tachometer, fuel gauge, ammeter, voltmeter, altimeter, oil pressure, oil temperature, pitch and bank indicator, switch, fuel pressure.

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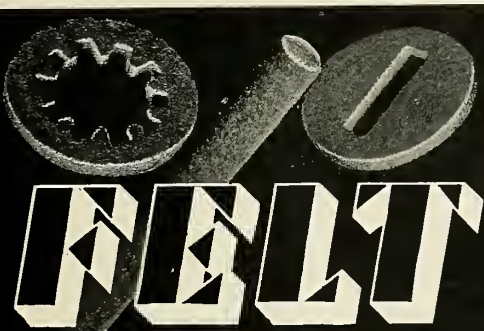

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Aeronautical personnel: Edmund T. Price, president; C. S. Marston, vice-president and secretary; A. W. Briggs, treasurer; Joseph Seamons, chief engineer; W. P. Clark, superintendent; Lon E. Wheeler, planning department and purchasing agent.

Aeronautical products: Exhaust collector rings (fabricated from stainless steel, soft iron and Inconel).

SPAULDING FIBRE CO., Tonawanda, N. Y.

Aeronautical personnel: R. B. Greene.

Aeronautical products: Fibre. Insulation material.

STANDARD BRASS MFG. CO.,
1300 Chestnut St., Kansas City, Mo.

Aeronautical products: Castings (aluminum).

STANDARD SCREW CO., Chicago, Ill.

Branch offices: Detroit Screw Co., 1469 E. Atwater St., Detroit, Mich.

Aeronautical products: Nuts and bolts.

E. J. STANTON & SONS, Los Angeles, Calif.

Aeronautical products: Spruce. Balsa wood.

STEEL IMPROVEMENT & FORGE CO.,
960 Addison Rd., Cleveland, Ohio

Aeronautical personnel: C. H. Smith, president.

Aeronautical products: Forgings (steel).

STEEL SALES COMPANY,
129 S. Jefferson St., Chicago, Ill.

Branch offices: 11341 Woodward, Detroit, Mich.

Aeronautical personnel: F. W. Walters, general sales manager.

Aeronautical products: Valve seats. Aluminum (flat sheets, bar stock).

SUNCOOK MILLS
34 Thomas St., New York, New York

Branch office: 10 State St., Boston, Mass.

Aeronautical personnel: (At Suncook, N. H.) W. Rodman Peabody, president; J. Linzee Weld, treasurer. (At New York) P. S. Howe, Jr., vice-president; V. Dietz, Jr., sales manager.

Aeronautical products: Fabric (*Flightex* covering; balloon fabric; glider fabric; manufactured to A & N specifications). Tape (*Flightex* pink and straight edge; pink and straight edge light weight; glider; reinforcing; manufactured to A & N specifications).

SUMMERILL TUBING CO., Bridgeport, Pa.

Distributor and sales representative: Edgar T. Ward's Sons Co., 44 Farnsworth St., Boston, Mass.; 39 River St., Buffalo, N. Y.; 4840 S. St. Louis Ave., Chicago, Ill.; 1210 E. 55 St., Cleveland, O.; 1300 Fort St., Detroit, Mich.; 1817 Frelinghuysen Ave., Newark, N. J.; Cedar & Westmoreland Sts., Philadelphia, Pa.; Woodkirk St., Pittsburgh, Pa.; American Industrial Bldg., Hartford, Conn.; Architects & Builders Bldg., Indianapolis, Ind.; Lincoln Alliance Bank Bldg., Rochester, N. Y.; 1210 Eleventh St., Rockford, Ill.; 1218 Olive St., St. Louis, Mo.; 765 Hampden Ave., St. Paul, Minn. Pacific Coast Representative: California Panel & Veneer Co., Los Angeles, Calif. Canadian Representative: B. W. Deane & Co., Ltd., Montreal, Canada.

Aeronautical personnel: E. L. Parker, president; J. P. Boore, assistant to the president; N. H. Wolf, vice-president; G. P. Kraemer, assistant treasurer; J. P. Dods, manager of sales; R. R. Lawson, general superintendent; Theodore Heske, production manager.

Aeronautical products: Tubing (chrome-molybdenum seamless steel; round, stream-line, square and oval).

T

DON TALLMADGE COMPANY,
132 W. 14th St., New York, N. Y.

Aeronautical products: Upholstery (fabric).

TANK BROTHERS,
623-633 S. Wabash, Chicago, Ill.

Aeronautical personnel: J. Fullersack.

Aeronautical products: Wire (steel).

H. D. TAYLOR, Buffalo, N. Y.

Aeronautical products: Upholstery (leather).

TEICHER MANUFACTURING COMPANY,
30-15 47 Ave., Long Island City, N. Y.

Aeronautical personnel: Arthur A. Teicher, president.

Aeronautical products: Stamped and spun parts (engine cowls; fairings; wheel housings; streamlinings).

J. H. THORP & COMPANY,
250 Park Ave., New York, N. Y.

Aeronautical products: Carpets.

THRESHER VARNISH CO., Dayton, Ohio

Aeronautical personnel: P. W. Blue, assistant sales manager.

Aeronautical products: Varnish.

THOMAS WIRE & SPRING CO.,
Hoboken, New Jersey

Aeronautical products: Springs.

THOMPSON PRODUCTS, INCORPORATED
2196 Clarkwood Rd., Cleveland, O.

Aeronautical personnel: F. C. Crawford, president; L. M. Clegg, vice-president and general sales manager; A. T. Colwell, director of engineering; J. R. Cox, director of manufacturing; E. C. Williams, director of purchasing.

Aeronautical products: Valves. Valve seat inserts. Valve guides. Valve retainer locks. Piston pins.

THURSTON CUTTING CORPORATION,
40 Worth St., New York, N. Y.

Aeronautical personnel: W. Harris Thurston, president.

Aeronautical products: Covering (fabric).

TIMKEN ROLLER BEARING CO., Canton, O.

Factories: Canton, Columbus and Wooster, Ohio.

Branch offices: Birmingham, Ala.; Boston, Mass.; Buffalo and New York, N. Y.; Chicago, Ill.; Cincinnati, and Cleveland, Ohio; Dallas, Tex.; Detroit, Mich.; Huntington, W. Va.; Milwaukee, Wisc.; Philadelphia and Pittsburgh, Pa.; San Francisco, Calif.; Seattle, Wash.; St. Louis, Mo.; Toronto, Canada; Washington, D. C.

Aeronautical personnel: W. B. Moore, Aeronautical personnel: L. M. Klinedinst, vice-president in charge of sales; W. B. Moore, general manager.

Aeronautical products: 'Ball bearings (single and double row; thrust; tapered).

TIMKEN STEEL & TUBE CO., Canton, Ohio

Aeronautical products: Steel (bar).

TITAN METAL MANUFACTURING CO.,
Bellefonte, Pennsylvania

Aeronautical products: Brass and bronze.

TITANINE, INC., Union, N. J.

Aeronautical personnel: E. G. Davis, president and general manager; W. A. Bagley, sales manager and assistant treasurer.

Aeronautical products: Dope (*Ti-two* semi pigmented). Lacquer. Enamel. Varnish. Thinner. Reducer. Retarder.

TITEFLEX METAL HOSE COMPANY
500 Frelinghuysen Ave., Newark, N. J.

Branch offices: General Motors Bldg., Detroit, Mich.; Hippodrome Bldg., Cleveland, O.; Merchandise Mart, Chicago, Ill.; Bourse Bldg., Philadelphia, Pa.; 950 Van Ness Ave., San Francisco, Calif.; 49 Federal St., Boston, Mass.; Walbridge Bldg., Buffalo, N. Y.

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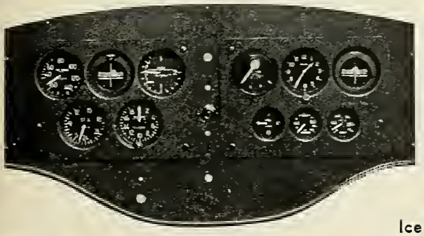

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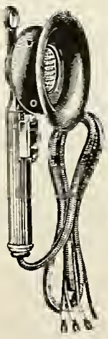

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Aeronautical products: Tubing (*Titeflex* flexible metal). Hose (*Titeflex* flexible metal).

THE TORRINGTON CO., Torrington, Conn.

Branch offices: 2457 Woodward Ave., Detroit, Mich.; 538 S. Wells St., Chicago, Ill.; 1640 Fairmount Ave., Philadelphia, Pa.; 321 W. Pico St., Los Angeles, Calif.; 1028 Geary St., San Francisco, Calif.

Aeronautical personnel: F. T. Case, sales manager, bearings department.

Aeronautical products: Ball bearings (open and closed type; shielded). Needle bearings. Metal specialties.

U

UNION DRAWN STEEL COMPANY,
Massillon, Ohio

Factory: Beaver Falls, Pa.

Aeronautical personnel: Fred C. Young, general sales manager; Elmer J. Kopf, sales promotion department.

Aeronautical products: Crankshafts.

UNITED AIRCRAFT PRODUCTS, INC.,
Dayton, Ohio

Aeronautical personnel: T. M. Hiester, president; Joseph G. Lehman, treasurer; R. G. Dykeman, chief engineer.

Aeronautical products: Valves. Pumps. Fuel line fittings. Shut-off cocks.

U. S. FLEXIBLE METALLIC TUBING CO.,
65 Main St., San Francisco, Calif.

Factory: Pennsylvania Flexible Metallic Tubing Co., 72nd & Powers Lane, Philadelphia, Pa.

Branches: Los Angeles, Calif.; Seattle, Wash.

Aeronautical personnel: F. A. McDonald, manager.

Aeronautical products: Flexible tubing.

U. S. FOUNDRIES, INCORPORATED,
3975 Williams St., Denver, Colo.

Aeronautical products: Castings (steel).

U. S. GRAPHITE COMPANY,
1430 Holland Ave., Saginaw, Mich.

Aeronautical products: Bushings (steel).

U. S. HAMMERED PISTON RING CO.
Paterson, New Jersey.

Aeronautical personnel: Albert Wenzel and A. Sandouw.

Aeronautical products: Piston rings.

U. S. PLYWOOD COMPANY,
103 Park Ave., New York, N. Y.

Aeronautical personnel: J. J. Dunne, manager aircraft division.

Aeronautical products: Plywood.

UNITED STATES RUBBER PRODUCTS, INC.,
1790 Broadway, New York, N. Y.

Factories: Providence, R. I.; Naugatuck, Conn.; Passaic, N. J.; Detroit, Mich.; Los Angeles, Calif.

Branch offices: 204 Walker St., S.W., Atlanta, Ga.; 429 S. Charles St., Baltimore, Md.; 5 N. 20 St., Birmingham, Ala.; 560 Atlantic Ave., Boston, Mass.; 133 Swan St., Buffalo, N. Y.; 440 W. Washington St., Chicago, Ill.; 1101 Central Parkway, Cincinnati, O.; 1235 W. 6 St., Cleveland, O.; 1039 Young St., Dallas, Tex.; 875 Broadway, Denver, Colo.; 1326 W. Walnut St., Des Moines, Ia.; 6670 E. Jefferson Ave., Detroit, Mich.; 1407 Park St., Hartford, Conn.; 1312 Franklin Ave., Houston, Tex.; 590 E. Louisiana St., Indianapolis, Ind.; 313 W. 8 St., Kansas City, Mo.; 784 San Pedro St., Los Angeles, Calif.; 345 2nd St., Memphis, Tenn.; 447 N. Water St., Milwaukee, Wisc.; 500 S. 3rd St., Minneapolis, Minn.; 202 Fulton St., New Orleans, La.; 240 W. 60 St., New York, N. Y.; 901 Douglas St., Omaha, Neb.; 5th & Locust St., Philadelphia, Pa.; 601 General Robinson St., Pittsburgh, Pa.; 435 N.W. 6th St., Portland, Ore.; 309 W. Martlin St., Raleigh, N.C.; 1015 Washington St., St. Louis, Mo.; 160 Motor Ave., Salt Lake City, Utah; 300 Second St., San Francisco, Calif.; 212 Jackson St., Seattle, Wash.; 1011 First Ave., Spokane, Wash.; 125 Marcellus St., Syracuse, N. Y.

Aeronautical personnel: J. A. Faucher, tire sales; H. A. Everlein, mechanical rubber utilities.

Aeronautical products: Rubber utilities (gaskets; packing; tubing: oil, water, fuel hose; rubber matting; grommets; rings; bumpers; pedal pads: flexible pipe; control wheels; washers). Tires and tubes. Insulated wire. Artificial leather. Waterproof clothing. Shock absorbers.

U. S. STEEL CORPORATION, Pittsburgh, Pa.

Aeronautical personnel: H. V. Jamison.

Aeronautical products: Steel (stainless parts).

UNITED WIRE & SUPPLY CORP.,
Elmwood Station, Providence, R. I.

Aeronautical products: Fuel line tubing.

V

VALENTINE & COMPANY, New York, N. Y.

Aeronautical personnel: C. E. Whipple; T. W. Colton.

Aeronautical products: Paint. Varnish.

THE VELLUMOID COMPANY,
54 Rockdale St., Worcester, Mass.

Branch factory: 951 Porter St., Detroit, Mich.

Aeronautical personnel: Geo. C. Beals, treasurer and general manager; Charles S. Livingstone, sales manager; L. Wald, plant manager.

Aeronautical products: Sheet packing. Gaskets.

VICTOR MANUFACTURING & GASKET COMPANY,
5750 Roosevelt Road, Chicago, Ill.

Aeronautical personnel: J. H. Victor, president; J. B. Victor, vice-president; C. C. Secrist, secretary and sales manager; G. A. McAninch, treasurer; I. M. Larson, purchasing agent; A. Frymark, general manager.

Aeronautical products: Gaskets (copper asbestos; steel; asbestos; treated paper; cork; compressed asbestos; solid metal). Packing (treated paper *Victorite*, compressed asbestos sheet *Victopac*, cloth insert cork sheet *Corkolin*).

W

WARMAN STEEL CASTING CO.,
Boyle Ave., Los Angeles, Calif.

Aeronautical products: Castings (steel).

WATERBURY BUTTON COMPANY,
Waterbury, Conn.

Aeronautical products: Rivets (aluminum and steel).

WELLINGTON SEARS COMPANY, INC.
65 Worth St., New York, New York

Branch offices: Trust Company of Georgia Bldg., Atlanta, Ga.; 220 Devonshire St., Boston, Mass.; 222 West Adams St., Chicago, Ill.; Whitney Central Bldg., New Orleans, La.; 417 Market St., San Francisco, Calif.; 119 S. 4th St., Philadelphia, Pa.; Penobscot Bldg., Detroit, Mich.; Insurance Exchange Bldg., St. Louis, Mo.

Aeronautical products: Fabric (*HH* balloon cloth; *BA-30* covering; *BA-24* light-weight covering; *S 395* glider cloth). Tape *BA-30* and *HH* (pinked).

WESTERN FELT WORKS
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Branch offices: 42 E. 20th St., New York, N. Y.; 197 Arsenal St., Watertown, Mass.; 3118 N. Broad St., Philadelphia, Pa.; Stephenson Bldg., Detroit, Mich.; 750 Prospect Ave., Cleveland, O.; 519 Main St., Cincinnati, O.; Ambassador Bldg., St. Louis, Mo.; Second Unit Santa Fe Bldg., Dallas, Tex.; 1166 Detroit St., Denver, Colo.; 762 E. Pico St., Los Angeles, Calif.; 1239 Howard St., San Francisco, Calif.; 712 Fourth St., Seattle, Wash.; 14 S. W. 5th Ave., Portland, Ore.

Aeronautical products: Felt (valve rocker oiling pad; cowling rocker box vibration absorber; soundproofing and vibration deadening).

(*Continued on following page*)

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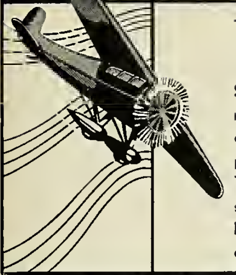

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WASP Jr. 420 h.p. motor, six-passenger, 140 miles per hour cruising speed, real leather upholstery. Completely equipped with Hamilton variable pitch propeller, Lear radio, directional gyro, artificial horizon, bank and turn, rate of climb, manifold pressure gauge, Kollsman altimeter, flares, landing lights, electric starter, generator, double navigation lights, fairing and pants. Excellent condition throughout.

STINSON Monoplane:

LESS than one year old. Equipped with Smith variable pitch propeller, flaps, Pioneer compasses, directional gyro, artificial horizon, Kollsman altimeter, bank and turn, rate of climb, manifold pressure gauge, Lear radio, flares, landing lights, navigation lights, real leather upholstery, electric starter and generator.

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340 Crocker, Los Angeles, Calif.

Aeronautical products: Gaskets.

WESTINGHOUSE ELECTRIC & MFG. CO.
East Pittsburgh, Pennsylvania.

Factories: East Pittsburgh, Pa.; Attica, N. Y.; Chicopee Falls, Mass.; Cleveland, O.; Derry, Pa.; East Springfield, Mass.; Emeryville, Calif.; Mansfield, O.; Newark, N. J.; Pittsburgh, Pa.; St. Louis, Mo.; Sharon and South Philadelphia, Pa.

Branch offices: Phoenix, Ariz.; Los Angles, Oakland, San Francisco Calif.; New Haven, Conn.; Wilmington, Del.; Washington, D. C.; Jacksonville, Tampa, Fla.; Atlanta Ga.; Chicago, Peoria, Ill.; Evansville, Indianapolis, Ind.; Des Moines, Sioux City, Waterloo, Ia.; Wichita, Kans.; Augusta, Bangor, Me.; Baltimore, Md.; Boston, Springfield, Worcester, Mass.; Flint, Detroit, Grand Rapids, Mich.; Duluth, Minneapolis, St. Paul, Minn.; St. Louis, Mo.; Butte, Mont.; Omaha, Neb.; Newark, Trenton, N. J.; Albany, Binghamton, New York, Rochester, Syracuse, Utica, N. Y.; Charlotte, Raleigh, N. C.; Cleveland, Toledo, O.; Oklahoma City, Tulsa, Okla.; Portland, Ore.; Allentown, Philadelphia, Reading, York, Pa.; Providence, R. I.; Columbia, Greenville, S. C.; Memphis, Tenn.; Burlington, Vt.; Richmond, Va.; Dallas, Ft. Worth, Houston, San Antonio, Tex.; Seattle, Spokane, Wash.; Madison, Wisc.

Aeronautical products: Micarta products (control pulleys; fairleads; bushings; bearings, instrument and terminal boards; cabin lining). Battery indicators (voltmeters; ammeters; volt-ammeters). Dirigible equipment (light-weight generators; switchboards; search lights; controls). Radio power dynamotors. Electrically-operated fuel valves. Landing light lamps. *Nofuse* panel boards. Radio receivers and transmitters. Sentinel breakers. Airport and airway equipment (alidades; beacons; ceiling projectors; code flashers; floodlights, ornamental, landing field, hangar, fresnel; beacon lamps; marker cones and lights; Neon obstruction lights; on-course lights; searchlights; traffic signals; wind indicators). Insulating (cotton and treated cloth; treated fabrics; papers; micas). Cement. Compound. Micarta (gears; panels; sheets; tubing; channels; angles). Research laboratory equipment.

WHARTON & CO., Easton, Pa.

Aeronautical products: Cylinder barrels.

WICHITA WIRE PRODUCTS CO.,
Wichita, Kansas

Aeronautical personnel: D. E. Varner.

Aeronautical products: Coil springs. Cowling lock pins.

WHITE SUPPLY CO., St. Louis, Mo.

Aeronautical products: Fibre.

WHITEHEAD STAMPING CO.,
1661 W. Lafayette, Detroit, Mich.

Aeronautical products: Stampings.

WM. WIESE & CO., INC.,
234 W. 56 Street, New York, N. Y.

Aeronautical personnel: Wm. Wiese, president; C. A. Wiese, vice-president; M. W. Wiese, secretary.

Aeronautical products: Upholstery (cabin interiors). Carpeting. Curtain silk.

WILCOX-RICH CORP., Detroit, Mich.

Factories: Battle Creek, and Saginaw, Mich.

Aeronautical personnel: C. W. Miller, president; F. A. Buchda, secretary-treasurer; R. Jardine, chief engineer; H. G. Johnson, manager of sales (Rich division).

Aeronautical products: Valves (*Rich* salt-cooled). Valve seat inserts.

WILKENING MANUFACTURING CO.,
2000 S. 71st St., Philadelphia, Pa.

Aeronautical personnel: F. W. Wilkening, president; G. L. Briggs, vice-president in charge of sales and advertising.

Aeronautical products: Piston rings.

J. H. WILLIAMS & CO.,
75 Spring St., New York, N. Y.

Factory: Buffalo, N. Y.

Branch offices: 117 N. Jefferson St., Chicago, Ill.; 400 Vulcan St., Buffalo, N. Y.

Aeronautical personnel: J. Harvey Williams, president; A. D. Armitage, vice-president (Buffalo); J. C. Scanlon, manager special forgings division (Buffalo); W. F. Prindiville, engineer aircraft sales (Buffalo); W. H. Blocksidge, chief metallurgist (Buffalo).

Aeronautical products: Drop forgings for aircraft and aircraft engines heat-treated to specifications. Drop-forged tools.

WILLIAMS & COMPANY, INC.,
905 Pennsylvania Ave., Pittsburgh, Pa.

Aeronautical personnel: E. C. Edmundson, sales manager.

Aeronautical products: Aluminum (flat sheets).

WORCESTER STAMPED METAL COMPANY,
Worcester, Massachuetts

Aeronautical personnel: H. O. McCauley.

Aeronautical products: Stampings.

WOLVERINE TUBE COMPANY
1455 Central Ave., Detroit, Mich.

Aeronautical products: Tubing (copper).

WILMINGTON FIBRE SPECIALTY COMPANY
Wilmington, Delaware

Factory: New Castle, Delaware.

Branch offices: 838 W. Congress St., Chicago, Ill.; 3969 Kenkel Ave., Cincinnati, O.; 1514 Prospect Ave., Cleveland, O.; Colorado Bldg., Denver, Colo.; 8624 Gratiot Ave., Detroit, Mich.; 1001 E. First St., Los Angeles, Calif.; 16 E. Hennepin Ave., Minneapolis, Minn.; 30 Vesey St., New York, N. Y.; 401 N. Broad St., Philadelphia, Pa.; 405 Penn Ave., Pittsburgh, Pa.; Temple Bldg., Rochester, N. Y.; 134 Pierpont Ave., Salt Lake City, Utah; Tilden Sales Bldg., San Francisco, Calif.; 2128 Westlake Ave., Seattle, Wash.; Second National Bank Bldg., Toledo, O.; 155 Clearfield Rd., Hartford, Conn.

Aeronautical personnel: J. W. Morris, president; M. L. K. Armstrong, treasurer; H. M. Romig, sales manager; F. L. Gerhauser, production manager.

Aeronautical products: Fibre (sheet; tubing; round rod). Insulation (*Ohmoid* sheet; rod; tube, special shapes).

WOOD CONVERSION CO., Cloquet, Minn.

Aeronautical personnel: C. L. Hamilton; Clarence D. See.

Aeronautical products: Balsam wool. Soundproofing material. Insulation material.

WOODCRAFT CORP., Bay City, Mich.

Aeronautical products: Plywood.

WYMAN-GORDON CO., Worcester Mass.

Branch office: Book Bldg., Detroit, Mich.

Aeronautical personnel: J. H. Nelson, chief engineer; F. E. Wellington, manager; R. W. Stoddard, manager; R. M. Powell (Detroit) general sales manager.

Aeronautical products: Forgings (steel crankshafts, connecting rods, link rods, cam rims, propeller shafts, propeller hubs, cylinder heads, barrels, spiders; aluminum pistons, crankcases, propellers).

Y

YOHO & HOOKER, Youngstown, Ohio

Aeronautical personnel: John Yoho.

Aeronautical products: Plywood. Spruce.

YOST SUPERIOR CO., Springfield, Ohio

Aeronautical products: Springs.

L. A. YOUNG SPRING & WIRE COMPANY,
9200 Russell St., Detroit, Mich.

Aeronautical products: Springs.

New Cabin Luxury *by Irvin*

in Red, Green, Tan—your chosen color scheme—the utmost of comfort, with invisible Irvin safety in every seat, *ready for instant use.*

In emergency, passengers equipped with Irvin Chair Chutes merely rise from their seats, chute with them, and jump.

Irvin Chair Chute installation in Stinson plane. Preserves the fine appearance, the great comfort of this interior.

Embody all of the essential features of the standard Irvin Air Chutes that have saved over 1000 lives in emergencies. *Write about this equipment for your new ship.*

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THE AIR SERVICES

Comparative Military Strengths

FIGURES SHOWING the comparative air force strengths of Great Britain, France and Italy reveal that aircraft are playing major parts in military plans abroad.

Control of the Royal Air Force is vested in the Crown. The Secretary of State for Air, the Marquess of Londonderry, is head of the Air Ministry and president of the Air Council. Military aviation is separate and distinct from the Army and Navy, the Air Ministry holding a coordinate rank with Admiralty and the War Office.

No units are allocated to the Army. The Army Cooperation Squadrons work with the Army on call. The Fleet Air Arm is that part of the Royal Air Force allocated to the Navy, and approximately 70% of the pilots, and all observers are drawn from naval personnel.

The R. A. F. at present has 94 squadrons, 16 of which are attached to the Fleet Air Arm. The balance consists of 43 Home Defense Force squadrons, 5 Army Cooperation, 5 Flying Boat, 1 Communications, and 24 at foreign stations. There are approximately 2700 pilots.

The Squadron is the basic tactical unit. Higher organization contemplates the Wing and Group. The Group consists of two or more Wings; the Wing, two or more squadrons.

French Air Forces are under the authority of the Air Minister, who is advised by the Supreme Air Council and is assisted by the Inspector-General of the Air Forces; by the Chief of General Air Staff, and by the heads of the various military directorates of the Central Air Administration.

The military aviation is called the "Air Army," and is divided into three categories; that operating directly under the Air Minister (about 1/5), that attached for work with the army (about 4/5) and the squadrons detached for service with the Navy. Territorially, it is distributed among three air regions in France and a region in North Africa, with units detached for service in the colonies. The force consists of 2,127 officers, 29,800 men and approximately 3,500 planes of all types.

The Italian Air Force comprises all the military air forces of Italy and her colonies. The supreme authority is the Air Minister, who exercises his powers through the Chief of the Air Staff and through the commanders of the territorial air zones.

The Regia Aeronautica is organized into the Aeronautical Arm, Engineering Corps and the Commissiariat Corp.

The combat forces of the Regia Aeronautica, (which includes all military aircraft) is the Aerial Army, Aerial Units assigned to the Army, and to the Navy, and Colonial Aviation.

The basic tactical unit is a squadron, two or more of which form a wing; two or more wings, a group; two or more groups an aerial brigade; two or more brigades an aerial division.

The squadrons of each class of aviation in the Regia Aeronautica are 35 pursuit; 38 reconnaissance, and 34 bombardment.

Hamilton Field Dedicated

NEARLY 20,000 people witnessed the official dedication of Hamilton Field. Marvelous Marin, Inc., which had been instrumental in securing the site of Hamilton Field for an Army base, took charge of the dedication program.

One of the ceremonies of the day occurred as the Chairman of the Marin County Board of Supervisors tendered the deed for the 928 acres of Hamilton Field to Governor Frank F. Merriam, of California, who in turn proffered it to Brig. General Henry H. Arnold, the latter accepting it as the official representative of the War Department.

In an impressive talk, General Arnold touched on the military history of the district and the mission of the 1st Wing of the G. H. Q. Air Force in protecting the Bay districts. Parachute jumps with an aerial review by the 30 planes of the 7th Bombardment Group, in which Lieut.Colonel Clarence L. Tinker directed the maneuvers from his Bird O'Prey, with commands over the radio which were heard by all of the assembled thousands through the medium of an amplifier on the ground, contributed to the enjoyment of the event.

Al Bagshaw, District Attorney of Marin County, presided as Chairman at the dedicatory exercises. Other officials present were Brigadier-Generals James A. Woodruff; W. E. Gillmore; Major F. B. Calloway, Air Officer of the 9th Corps Area, and Warden J. B. Holohan of San Quentin Prison.

Instrument Flying at Kelly Field

THE INSTRUMENT flying check required by the Chief of the Air Corps has been completed by most of the officers at Kelly Field, and their training in instrument flying, added to that given students, has increased instrument flying at this station considerably. For example, the 39th Observation Squadron reports that during a recent month more than 320 hours of instrument flying was done in airplanes of the squadron alone. This unit is equipped with BT-2B airplanes in which the SCR-183 radio set is installed.

Aerial Survey of Fort Bragg Reservation

THE SECOND Photo Section, stationed at Langley Field, Va., has just completed an aerial survey of the Fort Bragg Reservation for the Corps of Engineers. This survey was made with a 5-lens mapping camera at an altitude of 20,000 feet.

This is an unusually high altitude for aerial mapping, and it necessitated the use of oxygen breathing apparatus for the pilot and the photographer. At an altitude of 20,000 feet, the camera used in this survey will photograph an area of 428.49 square miles with one exposure.

An aerial survey of the territory from Hampton Roads, to the Neuse River, N. C., is in process at the present time, being made for the United States Coast and Geodetic Survey. This governmental bureau will use the photographs to establish intermediate control points between their known control points, thus obviating the necessity of having a detailed survey made by the ground survey party.

Washington Guardsmen Now Radio-Equipped

ALL AIRPLANES of the 41st Division Aviation, Washington National Guard, Felts Field, Spokane, are now equipped with two-way radio communication apparatus.

This was made possible by delivery of five new type sets, four of which are the SCR-AA-185 sets, and one SCR-AA-146 ground station set. The airplane sets were installed in three O-38E's and one O-39, under the direction of 1st Lieut. Charles O. Holter, while the two old SCR-134 sets were installed in O-38B's.

Army Wants Retention of Chanute Field

THE WAR Department is making efforts to retain the school at Chanute Field, Rantoul, Ill., south of Chicago and are seeking added funds to expand air activities at Fort Sheridan, Chicago, and at Scott Field, Belleville, Ill., Maj. Gen. L. H. Bash, quartermaster general of the United States Army said recently at a dinner for Army and National Guard officers at the Army and Navy Club, Chicago.

Weld Commands New Unit

LIEUT. FRANK E. WELD, division commander of the U. S. Naval Reserve Aviation with headquarters at Lambert-St. Louis Airport, was assigned as base commander of the new naval reserve aviation base at Kansas City, Kan. The squadron will be known as VN-17 RD-9.

Lieut. Weld came to squadron VN-12 RD-9, St. Louis, Aug. 27, 1931.

AVIATION PEN SETS

IDEAL SALES STIMULATOR—TROPHY—GIFT

Write for our illustrated catalog describing 16 beautiful aviation models made of solid bronze finished in chrome or silver.

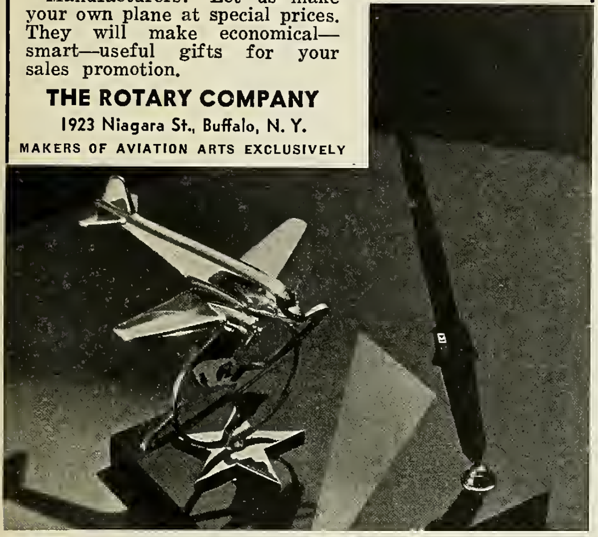
These are beautiful, true-scale models, accurate in every detail. The large bases are genuine marble and onyx with a WAHL "DORIC" PEN.

Manufacturers! Let us make your own plane at special prices. They will make economical—smart—useful gifts for your sales promotion.

THE ROTARY COMPANY
1923 Niagara St., Buffalo, N. Y.
MAKERS OF AVIATION ARTS EXCLUSIVELY

The DOUGLAS Pen Set

Illustrated—size of base 6½" x 6½". Plane has wing spread of 8". Write us direct. Price $17.50



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BALLOON AND AEROPLANE

A self-imposed weight maximum of 4 oz. to the square yard with a size content not to exceed 1 per cent. No starch or sizing. In BA-30 you get *all* cotton.

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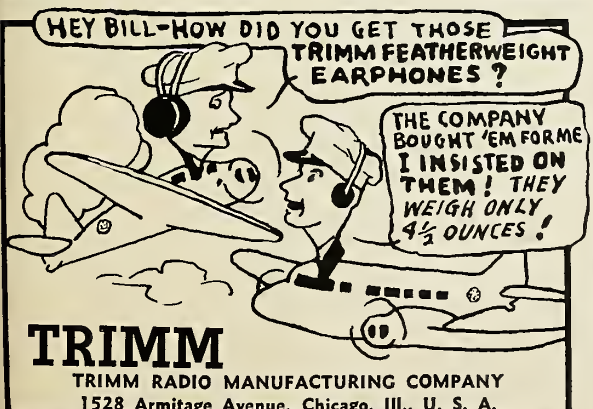
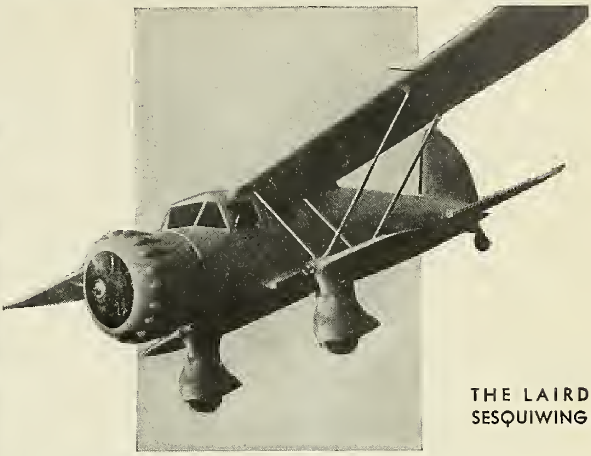
Branches in all cities



HEY BILL-HOW DID YOU GET THOSE TRIMM FEATHERWEIGHT EARPHONES?
THE COMPANY BOUGHT 'EM FOR ME I INSISTED ON THEM! THEY WEIGH ONLY 4½ OUNCES!

TRIMM
TRIMM RADIO MANUFACTURING COMPANY
1528 Armitage Avenue, Chicago, Ill., U. S. A.

LAIRD SESQUIWING



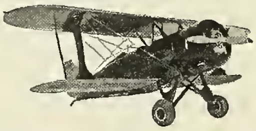
THE LAIRD SESQUIWING

WHEREVER fliers congregate, LAIRD performance is a by-word. In formal competition with the country's best, LAIRD planes have consistently flown away with the honors. And in the less conspicuous service of private owners LAIRD planes have set up unheralded records for dependability. « « Says a LAIRD owner: "What seems to attract the attention of the casual bystander is the remarkably high finish, in every particular, which you manage to put on the ship. It leaves an unmistakable impression of quality and class." « « Airplanes are bought today on performance plus appearance. Again LAIRD scores high. Supreme performance has been encased in graceful lines and strikingly beautiful finish. « « Three outstanding types to choose from: the SESQUIWING, six place closed cabin type; the SPEEDWING, three place open or closed cockpit type; the STANDARDWING, three place open cockpit type.

THE LAIRD STANDARDWING

Another LAIRD winner—no matter how you look at it. Three place. Powered with Wright J-6, 285 h.p. Does 150 m.p.h. wide open, cruises at 135 m.p.h., and lands at 45 m.p.h. Cruising range, 600 miles. Equipment includes metal prop, lights, RCA radio, brakes, starter.

THE LAIRD SPEEDWING



One of the snappiest—in performance and style—open cockpit planes in the air. Three-place. Powered with 300 h.p. Wright engine (or P & W Junior), 175 m.p.h. top, 155 m.p.h. cruising; 55 m.p.h. landing. Cruising range 550 miles. Equipment includes brakes, variable-pitch prop, lights, compass.

LAIRD airplanes are "Custom Built" for the sportsman, the flying business executive, and the transport operator whose chief interest is high efficiency and dependability rather than price. We invite such buyers to write for detailed information.

E. M. LAIRD AIRPLANE COMPANY
5301 W. 65th Street, Chicago, Ill.

"THE THOROUGHBRED OF THE AIRWAYS"

AIRLINES AND AIR TRAVEL

Schedule Revisions

BEGINNING JUNE 21, Boston-Maine Airways' passenger, mail and express service was extended to include Bar Harbor three days each week. This provides a connecting schedule via Boston between New York and the summer resorts in that vicinity.

Braniff Airways inaugurated a new Dallas-Houston-Brownsville service with Lockheed Electras which connect with Pan American Airways' planes to Mexico City and provide the first direct service between Houston and Brownsville. These planes also make available fast service from Chicago and Brownsville since they operate on an overnight schedule between the two cities. As the line begins its second year of operation it is preparing to offer a new connection between Oklahoma City, Washington, and New York with a connection with TWA planes at Kansas City.

Nashville, Tenn., was added as a stop on the Chicago-Miami line operated by Eastern Airlines. Chicago is now 3 hours 15 minutes from Nashville, and Miami 6 hours 55 minutes.

The Post Office Department has authorized National Parks Airways, Inc., to operate daily flights to West Yellowstone as a portion of the regularly scheduled flight. These flights will provide Salt Lake City with early morning and afternoon flights to the gateway of Yellowstone Park.

Northwest Airlines plans to foster an expansion program, part of which will be a 318-mile route extension to Portland, via Yakima, from Spokane. Service will be operated with twin-engined Electra transports. The company inaugurated a fourth round-trip between the Twin Cities and Chicago on June 1.

Another daily round-trip flight from Chicago to New York was inaugurated June 3 by United Air Lines. Routed by way of Toledo and Cleveland, the scheduled time is 4 hours 15 minutes in new Boeing 247-D transports. This brings United's total flights between the two cities to 20 every 24 hours. United, however, discontinued its Chicago-Kansas City line on the same date when competition of three airlines and five railroads forced the non-mail carrying operation out of existence. Other changes in schedules resulted in overnight service from New York and other eastern sections to all leading Pacific coast cities. Faster and more frequent service on United's mid-continent coast-to-coast route was inaugurated. Planes now leaving New York at 4.25 P. M. or, at or after, the close of the business day reach Los Angeles, San Diego, San Francisco, Portland, Seattle, and other coast cities at the breakfast hour. A feature of the schedule changes was the reduction in time from Chicago to Washington with a flight of 3 hours 55 minutes. This service is operated in conjunction with Pennsylvania Airlines which also is flying Boeing transports. United is now flying 1,500,000 miles each month, or 47,314 miles a day.

Personnel Changes

LOUIS M. Leffingwell has been elected president of Northwest Airlines, succeeding Shreve M. Archer who resigned several months ago. Mr. Leffingwell is also vice-president of Archer, Daniels, Midland Co., and is identified with a number of leading Minneapolis business firms.

Odell Garrison, who was for several years a commercial operator at the Birmingham, Ala., municipal airport, has joined Eastern Airlines as a pilot on the New York-Miami route.

S. E. Collins, Jr., assistant traffic manager in Chicago for American Airlines during the past four years, has been appointed city traffic manager in Cleveland, and Charles M. Urbach who has been with the traffic department of United Air Lines in Omaha, was transferred to San Diego to take charge of the United office there.

The following appointments to the staff of United Air Lines ticket office in New York were announced by Harold Crary, vice-president in charge of traffic: Henry Hoey, G. B. Lambert, E. Galbos, L. Readdy, H. D. Whitney, John Farmer, and George Taylor. R. Colton has been employed in the Chicago traffic office, and Ned Parish in the Cleveland office, while Frank Thompson, and Sam Lieb have been added to the San Francisco staff. Pascal Cowan has been named press representative at San Francisco, and at the Boeing School of Aeronautics.

J. J. O'Donovan has been appointed assistant traffic manager in charge of passenger service for Pennsylvania Airlines, and D. A. Duff has been appointed assistant traffic manager in charge of sales promotion. Other changes in personnel include the transfer of H. E. Kennedy, district traffic manager in Cleveland to Detroit; the appointment of C. J. Miller, Jr. to replace Kennedy, and the appointment of E. Sullivan as district manager at Cleveland.

Three new stewardesses have been added to the staff of the American Airlines, at Chicago, Earl Ward, superintendent announced. They are Ann Margaret Becker, Ellen Jeanne Baird and Alta Gertrude Mahan, all graduate nurses.

Traffic Mileage At Peak

SCHEDULED AIRLINES in the United States broke an all-time record by flying 26,747,450 miles during the month of April, the second successive month that this total was pushed to a new high. The 24,750,894 passenger miles flown in March constituted a record performance at that time. The number of passengers carried was 61,499, far greater than the corresponding figure for any previous April, but not quite as large as the record total.

Based on the reports of the 21 companies operating during the month, the statistics (issued by the Department of Commerce) reveal that these lines flew 4,193,807 miles, carried 231,237 pounds of express, and flew 142,256,022 express miles in April.

The near-record month resulted in advances in traffic over all lines, particularly Pennsylvania Airlines which set a new passenger mark over its Washington-Detroit route when 3709 passengers were carried. This is an increase of 405% over April, 1934. Since the beginning of the year the company carried 11,084 passengers as against 3258 for the same period in 1934.

Striking gains in traffic on United Air Lines were also indicated by reports from Portland which show a gain of 22% over March, 92% over February, and approximately 100% over April, 1934.

New Airline Services

WITH SAN DIEGO headquarters based at Lindbergh Field, the Los Angeles Airways inaugurated schedule airline service between Agua Caliente, San Diego, Long Beach, and Los Angeles. Using tri-motor equipment, the new company is providing four additional daily schedules between these cities. Los Angeles headquarters are at the Municipal Airport, Inglewood.

Verne Gorst inaugurated transport service with a Boeing flying boat in the Juneau, Alaska region, marking his reentry into the Alaskan field, where he inaugurated his transportation career. Gorst is continuing the Bremerton Air Ferry service in the Puget Sound.

Equipment for Airlines

TO MEET the demands of heavy traffic caused by its high-speed service, Northwest Airlines added three more Electras to its fleet, making 12 such planes flying the northern transcontinental route.

Delivery of five new Stinson Model A Airliners to Central Airlines, Inc., operators of the Detroit-Washington service will materially speed service between these cities, and improve passenger accommodations. These planes have been designed and engineered to meet the requirements of the routes over which they will fly.

NEW *Spartan* 3 ★★★ STAR COURSES
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ACTIVITIES AT THE SCHOOLS

C-W Gets Mechanic's Approval

RECOGNITION OF the Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal, Glendale, Calif, has been granted in the Department of Commerce's issuance of an approved mechanic's school certificate. Although the Department's approval of flying schools, and ground schools connected with flying schools, has been practiced for the past five years, the approval of mechanic schools has but recently been provided for. The schools that have received government approval have received this distinction within the last few weeks.

The school adopted a new grading system so that students may be justly graded on practical work which could be interpreted by the student's prospective employer.

The grades given under the new system and their meanings are as follows: "above average," which is recommendable; "average," which is passing; "below average," which is conditional; and "failure." In addition the exceptional student who is not only above average but decidedly superior is given an honor notation on his diploma.

Summer Courses Offered

SPECIAL COURSES during the summer months at various schools have been announced. In one case, regular courses begin early this month as the school starts its new semester.

The regular summer term at Parks Air College is to start July 8, the last enrollment until the Fall semester, thus allowing students who desire to do so, to gain a three-months start in their training.

At the Curtiss-Wright Technical Institute of Aeronautics, the fourth annual special summer vocational course for public high school teachers began June 24 with an enrollment of about 50.

Lieut. Comdr. P. V. H. Weems plans to inaugurate a summer course in air navigation at the Ross Garey Camp in Oakland, Md.

Schools Acquire Equipment

TWO NEW Aeronca planes have been added to the fleet of the Grand Central Flying School operated by Joe Plosser at Grand Central Air Terminal, Glendale, Calif., and the Boeing School of Aeronautics, Oakland, has added a Wasp-powered Boeing 80 tri-motored biplane to its training fleet. This plane will be used in cross-country flying, instrument flying, and for training in first and second pilot duties.

Four new engines have been added to the Spartan ground school equipment; including a Pratt & Whitney Wasp S1-D1, a Wright Cyclone, a Wright J6-9 and a Wright J6-5. This brings the total number of engines available for ground instruction to 24, with twelve various makes represented. Work has been started in the welding shop to construct mounts for the Wasp and Cyclone engines in order that they may be operated on the test stands.

Stewart Students Visit Plant

THE STUDENT body of the Stewart Technical School were recently taken on an inspection tour of the U. S. Naval Aircraft Factory at Philadelphia, Pa., where they were given the opportunity of observing the methods employed by the Navy and the maintainance and service of naval aircraft equipment. The Aircraft Engine Overhaul Shop and the Airplane Shop in which the Navy airplanes are repaired and built drew the greatest share of interest. Among other departments visited were the Metal Department, Engineering Department and the Parachute Factory. They also were taken through the test rooms where the engines are run in after their major overhauls.

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July, 1935

My 1935 Catalogue of Aviation Supplies and Materials consists of 44 pages 9" x 12", just about half again as large as the catalogue I put out last year. While the catalogue is half again as big, many prices are still lower than last year, in fact it's cram full of bargains.

Unfortunately for me, and for you, it's costing me as near as I can figure 25¢ or 30¢ apiece to print this new catalogue, address it and deliver it to you. I say it's unfortunate, because I would like very much to send one of the 1935 catalogues to every one interested in aviation but I can hardly afford to do this because there are now 37.642 fellows like you who are interested in the stuff I sell.

In order to keep my prices down, and I am still trying hard to do that in the 1935 catalogue, it is necessary to watch expenditures very closely. If I didn't, I would have to charge higher prices in order to make up for the cost of sending catalogues to people who didn't want them. Therefore, I am going to make you a sporting proposition. If you will send me a dime, being sure to write your name and present address on the coupon below, I will add twenty cents of my own money to it and send you a new catalogue right away. Better than that, I will see that you get the latest bargain bulletins during 1935 as fast as they are printed and refund your dime with your first purchase.

I hope that you will be as tickled with the new two color catalogue as I am and I know that you will find the prices very low. If I don't hear from you I will understand that you are not interested but if you want the catalogue don't delay a moment but send the dime right away today because it will help me to tell the printer exactly how many copies of the catalogue he should print and you will receive a copy promptly without having to wait for a reprint in case the first edition is exhausted before your reply is received.

Perhaps you remember how Will Rogers told a guy who said he didn't like his programs that he had no sympathy with anyone too lazy to turn the dial:--well, if you are willing to pay high prices for aircraft materials because you're too lazy to send me your address and a dime when I provide a coupon to make it extra easy for you, you don't deserve any sympathy either

Yours very truly,

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PRIVATE FLYING AND CLUB NEWS

More Air Races Scheduled

WITH THE air race season rapidly approaching its peak, a multitude of announcements concern events to take place in the immediate future, the most important being the 1935 National Air Races.

Cleveland again has been chosen as the locus, and for the second successive year Clifford and Philip Henderson will combine to conduct the races there. A minimum of $50,000 has been set aside for prize money and valuable trophies which will be awarded for the various events which will be run off from August 30 to September 2. The smaller planes are to be given a more prominent place in this year's races, and the women will get their chance in an ATC handicap for planes with a maximum speed of 150 m.p.h. Also included this year as features are the Bendix Transcontinental, Greve Trophy, and Thompson Trophy events.

The Sixth Annual National Soaring Contest got under way at Elmira, N. Y. June 29 for an extended run until July 14. Competition and attendance were at their greatest height since the contest was first introduced, with glider clubs and members from all sections of the country participating. Valuable prizes and awards of licenses will be made after the events are concluded including trophies by Sherman M. Fairchild, Edward S. Evans, the New York State Commission, H. Harris, and a cash award by duPont. Included in the prizes are aviation desk sets manufactured by the Rotary Co., Buffalo.

The Fourth Annual Roosevelt Field-Montreal International Good-Will Flight has been set for July 20-21. The tour is a non-commercial venture in which no fees are charged, and in previous years has attracted a considerable number of aircraft.

Air shows will be given every Sunday at Lambert-St. Louis Airport under the sponsorship of the Airport Association. A special program will be staged July 4.

With a record attendance of 30,000 last year, the Outboard Motor Regatta and Aircraft Display will attempt to surpass this figure August 25 when the combined event will be given at Gallipolis, Ind. More than $5,000 in prizes and awards has been set aside for both phases on the program.

Personnel Notes

THE SEATTLE Aviation Industries, cooperative association of Seattle aircraft operators, chose Allan Blum, president of Northwest Air Service, as its new head for the ensuing year. Other officers are Lana Kurtzer, vice-president; William Duwe, treasurer; Paul Mueller, secretary; Leonard R. Peterson, chairman of the board; and Jay Graybill, vice-chairman of the board.

Ohio has a physician who flies one of his several airplanes to distant parts of the state to pick up his patients and transport them by air to a private hospital, which he maintains, in addition to the flying school and airport, and then gives them the necessary medical or surgical attention. He is Dr. E. D. McAllister, of Chillicothe, who recently took off from his own airport in one of his own planes to pick up and return to his hospital a patient situated in northern Ohio.

On June 11 the Chicago *Tribune* chartered a tri-motored Stinson piloted by Joseph Bailey, and a Bellanca Skyrocket, piloted by Oscar Hanold, from the Bluebird Air Service, Chicago Municipal Airport to deliver 4000 copies of the paper to delegates attending the Grass Roots Republican conclave at Spring, Ill.

FAIRCHILD "24"

AMERICA'S FASTEST
SELLING QUALITY AIRPLANE

NOW EQUIPPED with Fairchild Flaps . . . a split-balanced, instantly operated device perfected by Fairchild engineers . . . which decidedly increases the angle of descent and result in even slower landing speeds. Fairchild three-place cabin 24's are now available with either the Warner Super-Scarab or the Fairchild-built Ranger engine. Full details will be gladly furnished upon request. Fairchild Aircraft Corporation, Hagerstown, Md.

AT THE AIRPORTS

Airport Dedications

OPENINGS OF new flying fields were accompanied by numerous dedicatory exercises, not the least impressive being the air show staged for the debut of the Missoula, Mont., County Municipal Airport Board's Hale Field. More than 5000 persons came out to witness the flying program and race events. Winners of the race events were Leonard Peterson in a Ryan, and J. Zuber in a Stearman.

Aviation Week was celebrated in conjunction with the opening of the Ft. Pierce, Fla., municipal field. A number of service planes from Miami, Pensacola and Washington were in the air during the exercises.

Two cities in Michigan at Adrian and Rogers City put on air shows as a means of celebrating the opening of their new projects, and four other cities are preparing for official openings this month. Dedications will be held at Stambaugh on July 4; at Charlevoix, July 4-6; Frankfort, July 13; and at Northport on July 14.

Southern Cities Expect Port Funds

AIRPORT CONSTRUCTION in the South, halted with the abandonment of the CWA program, may be revived according to reports from Washington. Funds from the $4,800,000,000 works-relief appropriation may be used for this type of work and if funds are available Tennessee is expected to start work on 27 airports.

In the new program of airport construction, according to reports, every southern city of more than 10,000 population will be considered and if no airport facilities are had, fields may be constructed.

The Department of Commerce, it is understood, has ruled that cities now holding leases will have to come into full possession of the fields before funds will be provided for improvement.

Personnel Changes

HERBERT L. HANSEN secured a two-year lease on a 160-acre tract of land near Longview, Texas, where he plans to open a first class airport. Hansen is a pilot and is mapping the field, preparatory to grading runways, placing the hangar in good condition and opening the field for use.

Lou Garrett, was re-elected head of the Arkansas Airport Co., operators of Toney Field, Pine Bluff, Ark. George H. Adams was re-elected secretary; Kenneth Garrett, executive vice-president and general manager; F. G. Smart, vice-president; Jo Nichol, treasurer and Leslie Leas, assistant secretary and assistant treasurer. W. L. Toney, for whom the field was named, was re-elected a director.

J. H. Young is now the new chairman of an aviation committee appointed at Menominee, Wis., to foster activities at the local county airport during the summer. Other members of the committee are Frank Lemieux and Harold P. Westervelt.

A new airport committee has been named by the Madison, Wis., Association of Commerce consisting of John Icke chairman, Henry Robinson, Harvey Burr, O. G. Corben, Walter Hyland, Ralph Immell, Howard Morey, H. V. Millar, George Armbrecht, William Devince and Frank Blied.

Airports Handle More Traffic

THE ILLINOIS State Aeronautical commission issued a report claiming that Chicago municipal airport, used by seven transport lines, is the busiest field in the United States. Records show 104 regular transport flights in and out of the field every 24 hours. 15,000 passengers either arrived or departed during April. Plans for further airport expansion contemplated by Chicago and other downstate towns are proceeding.

Parks Commissioner Frank A Coon reported a 100% increase in air traffic at the Buffalo Airport in April, as compared with that month a year ago. In April, with 423 plane arrivals and 419 departures, against 368 and 361, respectively, for March, 4,446 passengers were carried, as against 3,539 in March.

New Services Offered

CAPE COD Seaplanes, Inc., renewed summer operations at the Coonamessett Lake base, North Falmouth, Mass. Two new ships have been purchased, a Jacobs-powered Waco cabin for charter, and a Bird for short hops and instruction. Both ships are equipped with Edo floats. Officers are: George B. Cluett 2nd, president and treasurer; and Guy A. Ham, Jr., secretary and pilot. Facilities are now being installed to handle fueling and servicing of transient seaplanes.

A new modern hangar, operated by Chicago Aviation Corp., which also operates Curtiss Reynolds Airport, Glenview, Ill., opened July 1st at the Chicago Municipal Airport offering service and storage facilities to commercial and private planes. This hangar is one of the most conveniently located at the airport and is completely equipped for every service. H. S. Darr, president, is in charge.

The management and personnel of the former Amphibions, Inc., have reorganized to form the Privateer Aircraft Engineering Co., to conduct the service, repair and rebuilding business of the former at Roosevelt Field, Garden City, N. Y. The new company also offers a pick-up and delivery service to aircraft owners.

New Companies Operating

THE OIL Field Airlines of Dallas has been incorporated by W. P. Luse, Eustis Myres and P. Paulson. It will conduct a general fixed-base business.

Meinke-Eldred Flying Service, Inc., was formed at Willoughby, Ohio. Incorporators of this company are Philip Meinke, Dewitt Eldred, Ruth Meinke, and Josephine Eldred.

Euclid Avenue Air Service has been formed in Cleveland, Ohio. Incorporators are Brooks W. MacCracken, Foster H. Pettay and Parker C. Williams; and the Chicago Air Cab Corp., has been organized and incorporated as dealers and operators of airplanes. H. S. Darr, G. D. Owsley and P. D. Beizer are listed as the incorporators, and the Chicago Aviation Corp., and Curtiss Reynolds Airport, Glenview, Ill., are given as correspondents. The company business address is Curtiss Reynolds Airport, Glenview, Ill.

Beach Flying Service are now operating at Pittsburgh-Butler Airport. Members of the organization are H. K. Beach, president; Chas. Beach, secretary and treasurer; C. R. Litzenberger, pilot and instructor; Ken Scholter and Floyd Stimson. The company owns and operates a Taylor Cub, New Standard and Stinson Reliant, and is specializing in primary and advanced student training.

Sites Surveyed For Radio Flying Units

ANTICIPATING EARLY delivery of necessary equipment, which has been on order for several months, the Bureau of Air Commerce, Department of Commerce, completed preparations for surveying sites adjacent to 12 airports for the installation of the adopted radio compass system for blind approaches.

Sites selected are Newark, N. J., Pittsburgh, Pa., Columbus and Cleveland, Ohio, Indianapolis, Ind., Chicago, Ill., St. Louis and Kansas City, Mo., Los Angeles and Oakland, Calif., Seattle, Wash., and Washington, D. C. The installation at Washington, D. C., will be for experimental purposes. The first two sets to be delivered will be installed immediately at Newark and Washington.

The radio blind landing transmitters are being made for the Bureau by the Army Air Corps at Wright Field.

Rex Martin, Assistant Director of Air Commerce for air navigation, will be in direct charge of the survey and installation work. He will be assisted by E. A. Cutrell, Bennett Griffin, A. J. LaBaie and W. S. Hinman, Jr.

In addition to the Army Air Corps radio installations, the Bureau contemplates the installation of a chain of lights on a straight line of approach to the principal runway of the airport for a distance of 2,700 feet. Further, two rows of lights flush with the ground are to be installed down the center of the runway.

THE INDUSTRY IN GENERAL

Air Show Programs Progress

REPORTS FROM officials of the All-American Aircraft Show, which will be held at the Detroit City Airport from July 20 to 28, indicate that space reservations are progressing favorably, and Ray Cooper, general manager, had already signed Beech Aircraft Corp., Stinson Aircraft Corp., Nicholas Beazley, Waco Airplane Company, and Taylor Aircraft Corp., for reservations in the main hangar there. Representative booths depicting the strides taken during the past two years in air transportation are being arranged by the major airlines of the country, and participation by leading European lines is also being planned.

In addition to the above, space reservations were received from Ailor Sales Corp.; Baker & Eberle; Berry Bros.; Curtiss-Wright Airplane Co.; Champion Spark Plug Co.; Gulf Refining; Porterfield Aircraft Co.; Pyle-National; Irving Air Chute; Hartung Aircraft; Rearwin Airplanes; Socony-Vacuum; Jacobs Aircraft Engine; The Texas Co.; Pittsburgh Plate Glass; Seabury & Sons; United American Bosch; TWA; Evans Appliance; Lycoming Motors; Smith Propellers; Continental Aircraft; Warner Aircraft Motors; Ryan Aircraft; Parker Appliance; the Aero Insurance Underwriters Co.; Private Flyers Association; 99'ers Club; Soaring Society of America; and the Detroit *News*.

In keeping with the sportsman pilot phase of the show, several on-to-Detroit events have been arranged. A group of amateurs from Washington will conduct their summer cruise to Detroit, and a special race on the last leg from Cincinnati into Detroit will be flown for several prizes. Similar events are being planned by sport flying leaders in Boston and Chicago.

Products of the Scintilla Magneto Co., Inc., will be exhibited in conjunction with those of other Bendix companies.

An aircraft show will also be held at the Bendix Municipal Airport August 3 and 4. Known as the Midwest Aviation Exposition, the affair will be featured by a display by squadrons of army planes, aerobatics by notable pilots, and a presentation of "A Panorama of Aviation." The trade show phase will depict the progress of aviation during the last quarter century. Capt. C. R. Bowers, manager of the airport, has been named by the South Bend Aviation Commission as managing director of the exposition.

April Exports $1,343,839

A SLIGHT decrease in sales of American aeronautical equipment abroad in April brought the value for the first four months of 1935 to $5,608,876. April business in foreign countries amounted to $1,343,839 with 32 aircraft and 51 engines, valued at $684,036 and $215,786 respectively, making up the bulk. Sales of parts and accessories amounted to $426,729, and of parachutes, $17,288. March, 1935, sales were $1,735,542.

Chinese purchases again accounted for the largest number of planes, 16. These brought $108,670, but the six planes shipped to the Netherlands had a total valuation of $456,240. Dutch buyers also accounted for 10 engines at $63,589, and $44,425 worth of accessories. China spent $91,324 to lead in parts and accessories purchases, but Japan with $90,238 was close behind.

Other countries in which aircraft were sold were two each in Nicaragua, Brazil and Mexico, and one each in Canada, Costa Rica, Turkey, and Egypt. Other engine sales were made in Canada (8), Mexico (5), Czechoslovakia, Italy, Sweden, Great Britain, Trinidad & Tobaggo (2 each) and in Panama, Germany, Honduras, Salvador, Argentina and Japan (1 each).

Sperry Celebrates Silver Anniversary

THE TWENTY-FIFTH anniversary of the founding of the Sperry Gyroscope Co., Inc., was celebrated by a dinner June 13 for 169 employees of fifteen years' or more standing. Guests of honor were the twenty-year employees, among whom were Thomas A. Morgan, chairman of the board; Reginald E. Gillmor, president and general manager; Preston R. Bassett, vice-president in charge of engineering; Herbert H. Thompson, secretary; Frederick C. Narvessen, assistant chief engineer; and John DePersia, foreman.

Among the guests were E. A. Pierce, George N. Armsby, J. Cheever Cowdin, John Sanderson and Alexander B. Boyce, trustees and directors of the corporation.

Personnel Notes

MAJOR E. E. ALDRIN, vice-president of the Stanavo Specification Board, and aviation manager of the Standard Oil Company of New Jersey has been appointed chairman of the 1935 Fuel and Lubricants Committee of the Aeronautical Chamber of Commerce, and Roger Q. Williams is now technical advisor and assistant to Milton Reynolds, president of Reynolds Appliance Corp., Chicago.

International Nickel Co., Inc., has added Harold L. Geiger to the field staff of its development and research division, and O. W. McMullan to the research staff.

J. W. MacMorris, formerly machine shop superintendent, has been named Chance Vought factory superintendent, and Joseph M. Barr has been named factory manager. Other changes at the Vought plant include the appointment of Robert Witbeck to the post of chief inspector.

Consolidated Officials Start New Firm

WITH THE removal of the Consolidated Aircraft Corp., to its new factory in San Diego, Calif., organization of a new manufacturing company by some of the major officials of the Consolidated company was announced recently. Reported to be backed by Buffalo financial resources, the new company will remain in that city and start operations in the radiator plant factory formerly occupied by the Consolidated company.

Headed by Lawrence D. Bell, formerly vice-president and general manager of Consolidated who resigned, the Buffalo company probably will be known as the Bell Aircraft Corp., and will concentrate its activities on military aircraft, for the time being, at least. Joining Mr. Bell will be Ray P. Whitman, his assistant at Consolidated, and Robert J. Woods, chief engineer and generally credited with the design of the YIP-25, and A-11 military types. In addition a great part of the personnel now employed by the Consolidated company probably will be retained by the new organization.

Since Consolidated is not scheduled to move until August 15, the Bell company will not take possession of the plant until September.

The key men in the new organization have had years of experience in aircraft manufacturing and design. Bell was associated with the Glenn L. Martin company from 1913 to 1925, and came to Buffalo in 1928 as vice-president in charge of sales, subsequently becoming vice-president and general manager of Consolidated.

Mr. Whitman was one of the first engineers employed by the aviation section of the Signal Corps, in 1916, remaining with the Army until 1924 when he resigned to accept a post with Consolidated. Woods has been one of the foremost designers of military craft in the country, designing, in addition to the above, the TA-1, TG-2, XP-900, and others.

Bureau Contracts for Auto-Engined Plane

AN AIRPLANE powered with an 8-cylinder automobile engine has been ordered by the Bureau of Air Commerce.

The contract, with the Arrow Aircraft and Motor Corp., Lincoln, Neb., makes a total of four projects in which possibilities of automobile engines for aviation purposes are being tested.

According to John H. Geisse, Chief of the Bureau's Development Section, the Arrow company already has flown the engine in an airplane in which it was substituted for the craft's regular aviation engine. The airplane, which is to be delivered to the Department of Commerce on or before October 22, was designed originally to accommodate the automobile engine. It will be a low wing monoplane with side-by-side seats in an open cockpit.

Sales and Dealer Appointments

A NEW 95 h.p. Ryan S-T monoplane has been delivered to Harry P. Bingham of New York City who will hangar the plane at the Long Island Aviation Country Club where he will act as dealer for the Ryan company. Another purchaser of a Ryan, this one a 125 h.p. craft, was James A. Dods, of Honolulu.

Among recent sales of Stinson trimotored Airliners, were three Executive models for individual use. One was sold to R. J. Reynolds, Winston-Salem, N. C.; another to William Randolph Hearst, and the third to John J. White of New York. The interior of the Reynolds plane is shown on page 16.

The Fairchild distributors, Richard Depew and Beckwith Havens of Roosevelt Field, report the sale of a new Fairchild "24" cabin monoplane with a 145 h.p. Warner engine to Henry Rosenfeld of New York City, and the sale of a Ranger-powered "24" to Leach Aircraft, Armonk, N. Y. Other Fairchild distributors have handled large sales, notably Texas Fairchild Sales Corp., of Houston whose records show the disposition of 13 new and 8 used ships during the past year. Delta Fairchild Sales Co., dealers in the Mississippi Delta section with headquarters at Greenwood, sold another "24" to J. G. Forshner.

Other sales made recently include the 8,000,000 gallon order received by Stanavo from United Air Lines, and one for 7,000 gallons of Stanavo Lubricant 3000 from the U. S. Army Air Corps which also bought 11,500 pounds of Stanavo Rocker Arm Grease Number 2.

Joseph T. Ryerson & Son., of Jersey City, Philadelphia, and Boston, have been appointed exclusive sales representatives in the Atlantic Coast states for the Ohio special seamless mechanical tubing, manufactured by Ohio Seamless Tube Co.

RCA Establishes Aviation Center

HANGAR ACCOMMODATIONS, radio installation and servicing facilities, office and resting space, as well as a working demonstration of the newest types of aviation radio apparatus are placed at the disposal of itinerant pilots by the RCA Manufacturing Co., at its newly established aviation radio headquarters, located at Camden's Central Airport, according to Mr. David S. Little, in charge of aviation sales.

(Continued on following page)

Digest of Recent Events

S-43 Takes Off On One Engine In Tests

BY TAKING OFF on only one of its two engines, the new P. & W. powered Sikorsky S-43 amphibion set a record by rising in 15 seconds from the waters of Long Island Sound at Bridgeport, Conn. Capt. Boris Sergievsky, chief pilot of the Sikorsky Aviation Corp., was at the controls of the plane on its initial test flight from the water. JUNE 5

Camden-New York Linked In 56-Minute Flight

COMMEMMORATION OF a pioneer flight from New York to Philadelphia made 25 years years before by the late C. K. Hamilton, was the occasion for a 56-minute flight between New York's municipal airport Floyd Bennett Field and Camden by Capt. E. V. Rickenbacker in a Douglas airliner owned by Eastern Air Lines. The Douglas was piloted by F. E. Davis with Russell Oppenheim as co-pilot. It left Floyd Bennett at 9.55 a.m. and returned after a short stop at Camden at 10.51 a.m. in contrast to an entire day spent by Hamilton when he made his flight. JUNE 14

S-42 Again Flies Pacific; Makes Flight To Midway

PAN AMERICAN Airways' Sikorsky S-42 made a second trans-Pacific flight from California to Honolulu in 17 hours 57 minutes, cutting 17 minutes from its previous time. Commanded by Capt. Edwin C. Musick, and a crew of five others, the plane followed the longest route, 2410 miles from Alameda into Pearl Harbor. Two days later, the plane left Honolulu for a 1323-mile flight to Midway Island. The return trip from Midway Island was delayed for two days, but the S-42 made the flight in 10 hours 4 minutes, most of it at an altitude of from 6000 to 8000 feet and by means of instruments. JUNE 13

Post Makes Fourth Stratosphere Attempt

WILEY POST was unsuccessful in his fourth attempt to span the continent through the substratosphere. Minus the retractable landing gear, dropped at the take-off from Burbank, Calif., the *Winnie Mae* landed at Wichita, Kans., after turning back from a point near Davenport, Ia., because of mechanical difficulties. After the flight, Post announced that if he made any more stratosphere flights he would do so in a plane especially suited to the purpose. JUNE 15

Light Plane Marks Established In Aeronca

CLAIMING TWO new international records for light seaplanes, Benjamin King, Washington pilot, flew his ship 200 miles on an 8-gallon tank of fuel, landing at Whitney's Landing Chesapeake Bay, after a flight from North Beach, Long Island. Accompanying him in his float-equipped Aeronca was Dan Brimm. The previous distance record for light seaplanes was set by Lalloutte and Albert, French pilots, with 76.155 miles. Weighing less than 770 pounds, the Aeronca came within two classifications, those weighing less than 1400 pounds, and those more than 770 pounds. JUNE 16

Maryse Hilz Reaches Record Altitude

A NEW woman's altitude record was claimed by Maryse Hilz, French aviatrix who flew her 600 horsepowered plane over Villacoublay to an altitude of 11,800 meters (38,704 feet). The reported altitude betters Mlle. Hilz's own record of 9,791 meters (32,114 feet) established August 19, 1932. JUNE 17

French Claim Distance Mark With 2707-Mile Flight

A NEW world's seaplane distance record has been claimed by the French as a result of a 2707-mile non-stop flight of the *Southern Cross* from Cherbourg to Ziguinchor, Senegal. A preliminary checking of instruments showed that the plane broke the former record, held by the Italians, by 230 kilometers (143 miles). The ship was commanded by Lieut. Hebrard and carried a crew composed of six members. JUNE 23

Marquise Negrone Beats Hilz's Altitude Mark

THREE DAYS after Maryse Hilz set a world's altitude record, the Marquise Carina Negrone, broke it with a flight of 12,043 meters, (39,511.075 feet) over the Celio Airport, Rome. The Marquise also holds the woman's record for seaplane altitude with a mark of 18,221.729 feet set May 5, 1934. JUNE 20

Coast Guardsman Sets Two Amphibion Records

LIEUT. R. L. BURKE, commandant of the Cape May Coast Guard station set a new world's record for amphibions with load of 500 kilograms flying over a 100-kilometer course when he flew his Grumman-powered by a Wright Cyclone engine at a speed of 173.945 m.p.h. to surpass the former record held by Major E. E. Aldrin of 159.781 m.p.h. Two days later Lieut. Burke flew the plane to 18,100 feet, to set a mark for future record-seekers to aim. JUNE 25

Key Brothers Set New Endurance Mark

THE OLD endurance record, set almost five years ago by the Hunter brothers, was finally conquered when Fred and Al Key flew their plane, the *Ole Miss* 554 hours 41 minutes 30 seconds and then continued on over the Meridian, Miss., airport. Before they came down, the men flew 653 hours 34 minutes. JULY 1

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(Continued from preceding page)

100th Douglas Completed

ALMOST A year to the day since the first one was placed in airline service, the 100th Douglas DC-2 transport moved up on the final production line, during the past month, at the Douglas Aircraft Co., Santa Monica, Calif.

No. 100, which is part of a fleet being delivered to American Airlines, is a standard model and duplicates the 99 previous all-metal, twin-engine transports that have been supplied to T.W.A., Eastern Air Lines, American Airlines and Pan American in this country and to numerous foreign concerns throughout the world.

During the past year Douglas has produced the transports at a rate of approximately one every three days. Some indication of the task involved is evidenced by the amount of material used. Among other parts each plane, according to Douglas officials, requires some $\frac{2}{5}$ miles of control cables, 1-$\frac{1}{3}$ miles of angle metal, 11,000 square feet of dural sheets, 175 pounds of rivets and 2146 square feet of soundproofing.

COMING EVENTS

The Sixth Annual National Soaring Contest will be held at Elmira, N. Y. June 29-July 14

•

A Regional Airport Conference under the auspices of the Aeronautical Chamber of Commerce will be held in Detroit, Mich. July 2-4

•

An air program will be given at the Lambert-St. Louis Airport under the auspices of the Airport Association featuring races, stunting, and parachute jumps. July 4

•

Aviation Day, a feature of the Connecticut Tercentenary celebration, will be held at South Meriden, Conn., under the supervision of the local American Legion Post. July 5

•

Aircraft Exhibit and Airport Dedication, Port Jervis, N. Y., will be held under the auspices of the Volunteer Firemen of Port Jervis with Carson Hinaman in charge. July 6-7

•

The Western Canada Air Races and Air Show will be held in Vancouver, B. C., under the auspices of the Junior Chamber of Civic Affairs. July 20

•

The fourth Annual Roosevelt Field-Montreal International Good-Will Flight will again be held. July 20-21

A class C Aircraft Show will be held at the Detroit City Airport, Detroit, Mich., under the direction of Ray Cooper. July 20-28

•

The Midwest Aviation Exposition, under the direction of Capt. C. R. Bowers, manager of the Bendix Municipal Airport will be held at that field for two days. August 3-4

•

International Aerial Competition will be held under the auspices of the Royal Aero Club of Italy at Rome. There will be a tour and an aerial competition held in conjunction with the event. August 24-30

•

An Outdoor Motor Regatta and Aircraft Display will be given at Gallipolis, Ind. Cash and valuable prizes will be awarded. August 25

•

America's Schools of Aviation Day at the California Pacific International Exposition, San Diego, Calif., will feature a complete aviation program. August 25

•

The 1935 National Air Races will be held at the Cleveland Municipal Airport under the direction of Cliff and Phil Henderson. Aug. 30-Sept. 2

•

Results of preceding Regional Airport Meetings will be discussed in Birmingham, Ala., Sept. 7.

Aviation Business Activity

ONE OF the outstanding transactions of the month saw the purchase of the assets and good-will of the Hurley-Townsend Corp., by the Bendix aviation interests. These will be merged with the Scintilla Magneto Co., Inc., which will continue the manufacture of the H-T spark plug at the Scintilla plant at Sidney, N. Y. It is expected part of the H-T personnel will remain with the Scintilla organization.

Automotive Fan & Bearing Co., of Jackson, Mich., manufacturers of aircraft wheels and brakes, in addition to other products, has been reorganized and is now the Hayes Industries, Inc. C. B. Hayes, is the new president and general manager. He was formerly head of the Hayes Wheel Co., and is a director of the Kelsey-Hayes Wheel Co.

Business of the Irving Air Chute Co., Inc., was substantially better the first quarter of this year, and employment larger, it was reported by George Waite, president, in announcing the dividend action taken by the board of directors. The regular dividend of 10 cents a share will be payable July 1 to stockholders of record June 20.

The Aviation Corp. announced that stockholders upon surrender, or after the first of this month of $5 par value stock will receive in exchange one share of $3 par value stock of the new Aviation Corp., stock of American Airlines, Inc., at the rate of one share for each 10 shares of old Aviation Corp., and stock of Canadian Colonial Airways, Inc., at the rate of one share for each 20 shares.

Production Continues Increase

HEALTHY INDICATIONS of increasing business are seen in Aeronautical Chamber of Commerce reports which show that aircraft production for commercial use is considerably ahead of last year's index in the first quarter of 1935.

In the period under consideration, 162 commercial units were produced, as well as 372 engines for the same class. In 1934, only 81 commercial airplanes were produced in the first three months of the year. Military engine and plane production, however, is lower with 99 aircraft and 68 engines reported as against 124 aircraft, and 125 engines in 1934. The decrease however, not large enough to offset the gains made in commercial production.

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Manufacturer of aircraft hardware and accessories, contractor to United States Government, will, upon request, forward a copy of its handbook of aircraft accessories to established aircraft manufacturers and aeronautical engineers.

FOREIGN NEWS IN BRIEF

Australasia

COOK STRAIT Airways Company has been formed in New Zealand to provide daily scheduled service between Blenheim and Wellington via a number of points. A technical adviser has been appointed and sent to England to study air transportation operations and investigate flying equipment suitable for the service.

THE POST office officially approved a flight from Australia to New Zealand by Sir Charles Kingsford Smith in the *Southern Cross* for the purpose of carrying a special jubilee air mail. Sir Charles had, in addition, planned to carry a quantity of commercial freight, and if the load was too great for one plane, planned to secure Ulm's *Faith in Australia.*

THE AIR Board has prepared estimates for an additional order of 36 planes for the Royal Australian Air Force. With the new order, a total of 114 new planes will have been provided for Australian defense since the three-year plan was adopted last year. The new order will, however, complete the plan. As part of the expansion of the Air Force, more than 150 fitters, radio experts, photographers, and other specialists are being enlisted in the permanent force.

BID OF the MacRobertson Miller Aviation Co., Ltd., has been accepted for operation of a weekly service between Ord River and Wyndham, West Australia, the service affording a permanent connection with the main service from Perth, which passes through Ord River weekly. The bids included requirements of the Australian aerial medical services for an extension of the aerial ambulance plan to the Kimberley district.

PLANS FOR a proposed trans-Tasman service have been submitted to the New Zealand Government by Sir Charles Kingsford Smith who hopes to operate two flights each way weekly with Douglas transports. He plans to form a company with a capital of £125,000, and asks the Australian and New Zealand Governments to guarantee a weekly revenue of £1200.

THE CIVIL Aviation Department has ordered the immediate construction of radio direction finding stations at Essenden (Melbourne) and Western Junction (Launceston, Tasmania) for the guidance of planes crossing Bass Strait.

Belgium

BELGIAN AIR Lines (SABENA) has recently taken delivery of a new Savoia-Marchetti S.73 for use on its routes in Europe and Africa. The new plane was built by Societa Idrovolanti Alta Italia of Milan and is a low wing monoplane with three Gnome-Rhone 600 h.p. engines, has accommodation for eighteen passengers and a crew of four.

THE SABENA fleet covered 17,103 miles during February, 1935, flying 51,344 passenger-miles, 2,116 ton-miles of freight and 285 ton-miles of mail. In comparison with the traffic figures for the same month last year, there was a decrease of 8,842 miles flown, and a reduction in freight and mail carried by respectively 3,082 and 27 ton-miles. On the other hand, passenger transport increased by 14,167 passenger-miles.

Canada

COL. L. R. LAFLECHE, Deputy-Minister of National Defense, announced that a contract has been awarded to the Fleet Aircraft Corporation of Canada, Ltd., for the assembly of 10 training planes for the Royal Canadian Air Force. The approximate cost of these planes will be $70,000, and they will be powered by British engines. In a recent report Hon. Grote Stirling, Minister of National Defense, announced that the force would be increased by 21 planes, 17 officers, and 167 men.

ACCIDENT STATISTICS compiled by the Civil Aviation Branch of the Department of National Defense in aircraft accidents during the last three years, showed that in 1934 Canadian aircraft flew 6,497,637 miles, and that in the 75,871 aircraft-hours required to fly that mileage, three passengers, seven flight personnel and two bystanders were fatally injured; and seven pilots and two passengers were hurt. The 1934 record shows one person killed per 928,234 miles, compared with one in 453,831 miles in 1933, and one in 571,141 in 1932.

CONSTRUCTION ON the new civil and commercial airport in Lima, Peru, has already begun. The field, when in operation, will serve for all non-military airplanes. This will release the field,

The new Holland-built Fokker F-XXXVI transport which is powered by four Wright Cyclone engines

A squadron of Fieseler F-5's before the start of the Deutschlandflug

now being used for both military and commercial purposes, which will be devoted to the Peruvian Army air service, and will allow the Government to realize its desire to have its own field exclusively for military use.

POSSIBILITIES OF a number of new international air routes using Toronto as a base are contained in recent developments. The Toronto Harbor Commissioners in discussing with their City Council the proposed new airport for the city, mentioned that certain interests are engaged in developing a new route from Buffalo via Toronto to Montreal, and from Buffalo, Toronto, Sudbury, northern Ontario, to the city of Winnipeg.

PARLIAMENT HAS voted $1,000,000 for a tunnel to be built from downtown Toronto to the new airport which is to be built on the island in Toronto bay. The tunnel is to be used for approach to the airport, as steamers use the narrow entrance, and a bridge would not be feasible. At present cars are allowed on the island, and the tunnel would privide this facility allowing cars only to reach the airport, which will be a combined sea and land base.

Three hundred planes used the sea harbor on Toronto's downtown waterfront last year. It is closed during the winter, but its lessees, Capreol & Austin, have reopened for the summer.

France

IN ACCORDANCE, with the new policy of the Air Ministry for the concentration and decentralization of French airplane factories, several manufacturers have just announced the region in which they are about to install their plants. Hanriot-Salmson will be installed at Bourges; Dewoitine at Toulouse, where structural parts of pursuit planes will be built, and Provencale de Constructions Aeronautiques at Marseilles will build the frame works for planes and do repair work on engines.

Although Farman announced that they would build a factory at Angers, this has not yet been confirmed.

SOCIETE FRANCAISE d'Aviation Nouvelle will shortly begin building Lowe-Wylde monoplanes, which in England are called B.E.C. and in Belgium, *Machoulas.* The structural part of the airplane will be built in a factory at Issy-les-Moulineaux, and the engines (Poinsard) at Montargis.

Germany

A NEW German service to Sweden is proposed by Deutsche Luft Hansa in line with its policy of trying to establish connections with the leading trade centers of the world. When the new airport at Bromma (near Stockholm) is completed, a direct service between Berlin and Stockholm will be inaugurated, the trip to take about 3½ hours. It is expected the service will begin during 1936. According to Luft Hansa plans, an emergency field is to be laid out on the island of Bornholm.

THE GERMAN Condor Syndicate, as of April 3, effected a re-arrangement of the schedule of its weekly air service, which enables mail to reach Europe from Argentina in approximately four days. Preliminary reports indicated that planes would leave Buenos Aires on Wednesday, arrive in Rio de Janeiro on Thursday, and then fly from that point to Natal during the night. Seaplanes employed in the trans-oceanic journey receive the mail at Natal and cross the South Atlantic on Friday, reaching the African coast on Saturday, with alternate stops at Seville, Marseilles Stuttgart will be reached on Sundays.

Great Britain

SLEEVE-VALVED engines will be put into production at the Bristol factory this autumn, following the satisfactory completion of a 450-hour test of a *Perseus* II which, for civil use, is rated 640-665 h.p. at normal r.p.m. and 740-770 h.p. at maximum r.p.m. Four of these engines will be installed in a Short airliner owned by Imperial Airways for extensive flight trials over that company's regular routes.

New machine shops and equipment are being built at the factory for the production of these engines. Up to the present, two sleeve-valved types have been announced, the *Perseus* and the 420-495 h.p. *Aquila.* Every engine will be equipped to take a controllable-pitch propeller.

APPROXIMATELY 350 planes, drawn from almost 40 squadrons, will be assembled for the Royal Review at Mildenhall aerodrome, Suffolk, July 6. The greater part will fly, in squadron formation, over Duxford aerodrome, Cambridgeshire, another R.A.F. station about twenty miles south-west of Mildenhall, with the heavy bomber units first,

followed in turn by light bombers and fighting planes.

The King will review the assembled squadrons drawn up in eight semi-circular rows. Accompanied by the Secretary of State for Air—the Marquess of Londonderry—the King and Queen will lunch in the officers' mess and then go to a dais, from which they will review the squadrons in flight.

SERVICES OF three British airway companies are to be coordinated by United Airways, which was recently formed to operate the Blackpool Corp., airport and airlines to various points in the Kingdom. The Blackpool Corp., will lease its airport to the company, and operations will be provided with two services daily each way between London and Blackpool, with frequent services between the latter and the Isle of Man. Further services are being scheduled between Carlisle and the Isle of Man. United also acquired an interest in Northern Scottish Airways, which at present operates a daily service from Glasgow, Renfrew to Campbelltown, Kintyre and the Isle of Islay on Scotland's west coast. In addition to the continuation of these existing services, extensions are planned to provide direct service between Glasgow and the Isle of Man.

ARRANGEMENTS HAVE been concluded between Elder Dempster Lines, Ltd., and Imperial Airways to form a joint company, to be known as Elders Colonial Airways, for the purpose of operating air service in West Africa. Arrangements are also being made for the opening this year by Imperial Airways of a service from Khartoum to Nigeria, which will provide a through connection from London to Lagos via Khartoum, El Fasher, Fort Lamy, Maidugari, Kano, Kaduna and Illorin. Elders Airways will operate an extension of this service to Accra and to Kumasi and Takoradi as soon as suitable ground organization is provided at these places. It is hoped to eventually provide a service to Freetown. Other local services, special charter work, etc., will be developed as the need arises.

Italy

THE ITALIAN manufacturer Breda, has completed test flights on two new all-metal airplanes, the first of which is intended for high-speed bombardment work and the other for ground attack. Both are characterized by their speed and maneuverability.

M. PELLEGRINI has been appointed General of the Aeronautical Squadrons of the Italian Aeronautic Staff in recent personnel changes. In addition Todeschini Lalli has been named Generale of Divisions; Messers Bernasconi and Illari, Generali of the Aerial Brigades; and General Lombard, Commander of the Fourth Aerial Territorial Zone.

Mexico

THE MINISTRY of War and Marine is considering the use of military planes for customs patrols along coasts and borders; fighting forest fires; combatting agricultural pests; making aerial surveys; mapping routes for new railroads and highways; and in long distance ambulance work.

PASSENGER, MAIL and express service has been established from Tuxtla Gutierrez, capital of Chiapas, to Pichucalco, Salto de Agua, Palenque, Palayas, Zaragoza and La Libertad, by the Sarabia brothers who have operated a coffee express service in Chiapas for several years.

APPLICATIONS FOR permits to operate passenger and express service between Mexico City and Guadalajara, and Guerrero and Oaxaca states, are being considered by the aviation department of the Ministry of Communications and Public Works.

COL. ROBERTO Fierro, chief of the aeronautical section of the Ministry of War and Marine, has received permission to accept the invitation to make a flight from Mexico to Bismark, North Dakota, where he will attend the gathering in honor of representative aviators of the world. Col. Fierro will make the flight with three other ranking Mexican aviators.

COMPANIA LINEAS Aereas Mineras, S. A., has applied for a permit to operate a service between Tayoltita, Durango and Eastacio Dimas and Mazatlan, Sinaloa. This airline will at first transport ore and material for Durango mining companies, and later mail and passengers.

SITES FOR landing fields are being sought in San Luis Potosi by a Federal military aviation commission headed by Col. Roberto Fierro. In addition, two fields, one at Ciudad Victoria, and the other at Chihuahua City, are now under construction, both of them being available to civilian pilots. The first will be one of the largest in Mexico, and when completed will be used by the Mexican Aviation Co., (Pan American Airways) on its Mexico City-Tampico-Brownsville route.

AIRPLANES ENGAGED in international passenger and freight service, and planes of foreign registry are forbidden to engage in local commercial flights in Mexico, under amendments to the general communications and transportations law. Special concessions must now be obtained to conduct such a service. Customs men are authorized to seize and impound planes on flights that make local commercial trips, to assure payments of fines (up to $300) for violation of the new law.

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VENDOR'S CONTRIBUTION

(*Continued from page* 36)

itself, or its supporting member. These deflections caused excessive localized loads which reduced the thickness of the oil film, followed by a sudden rise in temperature and its well-known disastrous effects.

Bronze has been used widely for the bearing shells of aircraft engines, as well as most engines of other types, mainly because the white-metal linings adhere readily to this material. It evidently was necessary, in correcting this sort of trouble in a well-supported bearing, to either employ a thicker bearing shell of bronze (which would take up much valuable space and add weight) or adopt a material which would not deflect so easily. While steel has a modulus of elasticity about twice that of any bronze, it was considered impossible to consistently bond white metal to this stronger material in production. Nevertheless, here was a problem demanding attention, and in due time it was solved.

There is no doubt that the story behind all of the metallurgical and manufacturing developments, which gave the aircraft engine designer dependable white-metal-lined steel bearings, should demonstrate our theme most effectively. But, it deserves more space than we possibly can devote to it here; besides, there are more advanced developments along this line which should command our first attention. We refer, of course, to the lead-bronze steel backed bearings that were developed by the Allison Engineering Co., and which are used in practically all of the aircraft engines produced in this country today.

This development originated ten years ago when it was found, in the course of testing a reduction gear driven by four Liberty engines, that the connecting rod bearings woud not run 50 hours without failure. The Liberty connecting rod was of the forked or straddle variety, with the blade or central rod bearing on the back of a bronze shell. The latter was secured in the forked member, and provided with a white-metal lining to bear on the crank-pin.

The repeated flexing of the bronze, which was common among connecting rods of this construction, was sufficient to cause a fatigue failure of the bond between the white metal and bronze. To overcome this difficulty without substituting new connecting rods, it was necessary to replace the bronze with steel, and place a bearing material as hard as the original bronze on the outside of the steel shell for the blade rod. The process of bonding a hard bronze to steel was the start of a research program that eventually led to the development of the present high-lead-bronze bearings.

The success with these bearings can be attributed largely to the strength of the bond, which investigation actually shows to have a mutual penetration of the bronze and steel. The penetration of the bronze is small and uniform when applied to carbon steels. Fractures in tensile tests occur in the bronze, which shows that the strength of the bond is greater than the bronze. This particular property of the bond between these metals safely permits greater heat at the bearing because of the high melting point of the copper-iron bond, and also greater heat conductivity from the lining to the shell.

Obviously, there were many difficulties to overcome in bringing these bearings to their present state of refinement. Some of the troubles were lead segregations, impurities, and unsound castings, which made themselves manifest in the form of excessive wear in service, as well as exceptionally high production costs.

In the micrograph (see page 36) of a high lead-bronze bearing, the copper is shown surrounded by lead, and there is a preponderence of copper particles where the lining joins the steel shell. The other micrograph shown (also at the bottom of page 36 and at 100 magnifications) was taken at the surface of

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Wearing Qualities Improved

Wear tests on these high lead-bronze bearings actually show that they may be operated at much higher loads, and with less wear, than bearings having white-metal linings. To convey a small idea of the improvement, let us consider once that a nickel steel journal (54 scleroscope hardness), of 2 in. diameter and 1 in. width, was operated under a centrifugal load of 2600 lbs./sq. in. on a bearing of 60% copper and 40% lead for a 200-hour period. The clearance at the start of the run was .002 in. and, at the end, the journal had worn .001 in. and the bearing .0006 in.

Perhaps these results may be judged more readily by comparison if we explain that the (*PV*) rubbing factor (unit load-lb./sq. in. × peripheral velocity-ft. sec.), in the above tests, was 84,000. Not so many years back it was considered that a *PV* factor of 30,000 was the maximum that could be maintained with safety. At present, these high lead-bronze bearings are operating satisfactorily in military aircraft engines at dive speeds of 2150 r.p.m. and loads of 3400 lbs./sq. in. on the projected area. Tests are now in process in which bearings are operated at unit loads of 5,000 lbs./sq. in. and *PV* factors of 300,000. On the basis of *PV* factors, whatever their true meaning, we may be permitted to regard bearings to have been improved to such a point that they are around ten times as good as they were ten years ago.

Note: The author wishes to gratefully acknowledge the assistance of Mr. G. A. Welty of the Aluminum Company of America, Mr. A. T. Colwell of the Thompson Products, Inc., and Mr. George A. Zinck of the Allison Engineering Co. in supplying some of the data used in the preparation of this article.

DIGEST OF TECHNICAL ARTICLES

(*Continued from page* 28)

Crankshaft Vibration

Torsional Vibration of Crankshafts (Drgania skrętne watów), K. Wolski. Sprawozdania, Instytut Badań Technicznych Lotnictwa (Polish Institute of Aeronautical Research), No. 1 (16), 1935, *pp.* 44-65, 16 *figs.*, 33 *equations.*

THE PROBLEM of free vibrations in a system of simple motor shafts and couplings is investigated for isolated masses. The author develops equations for simple and parallel systems, a geared system and a system of replacement, all in series, as well as for a mixed system. He explains an approximate method for taking into account the moment of inertia of the shaft and considers the possibilities for applying this method to the calculations of crankshafts for airplane engines. He concludes with a discussion of the effect of the elasticity of the gear teeth and the continuity of the gearing.

Braced Frameworks

On the Calculation of Stresses in Braced Frameworks. V. The General Solution for a Cylindrical Tube of Regular Polygonal Cross Section, R. V. Southwell and J. B. B. Owen. (British) Aeronautical Research Committee—Reports and Memoranda No. 1573, *June* 19, 1933 (*published May* 21, 1935), 87 *pp.*, 2 *figs.*

A METHOD was developed in a recent report for the exact solution of the stresses in a tubular framework which is divided by bulkheads into any number of similar bays, the bulkheads being taken to be of regular polygonal form and braced by wires which run from a central point to each corner of the polygon. This method is explained in this report for the benefit of the designer of rigid-airship hulls or monocoque airplane fuselages who may wish to apply it.

Part I contains a resume of the underlying theory with some new relations required, while in Part II all bulkheads are assumed to have radial bracing of the same stiffness. Part III takes up the modifications required when only terminal bulkheads are braced. The last part deals with stiff transverse rings.

Accelerometer Records

The Normal Acceleration Experienced by Aeroplanes Flying through Vertical Air, Part II. The Interpretation of Accelerometer Records, H. R. Fisher. (British) Aeronautical Research Committee—Reports and Memoranda No. 1629, *January* 1, 1934 (*published May* 15, 1935) 16 *pp.*, 25 *figs.*

THE MATERIAL of a previous report is developed in so far as it may be applied to the deduction of information on the structure of atmospheric turbulence from records of normal acceleration. In records taken mostly in cumulus clouds several traces were found to be attributed to well-defined local and extended vertical currents reaching their maxima in from 50 to 100 feet and usually accompanied by small boundary eddies, while independent horizontal eddies of from 100 to 200 feet in diameter also appeared to be frequent.

The author recommends that measurements for the comparison of gusts be made from a mean acceleration if this is positive, since lateral motions and variations in forward speed are liable to produce on the average a positive upward acceleration. To obtain information on the structure of gusts, he believes that an aircraft as small as possible should be used as gust loads on a large aircraft of twice its size can be conveniently estimated. The most direct and satisfactory measurement of gust loads in any particular case, he considers, is by means of wing deflection and that, if a single accelerometer is used, it should be supplemented by a record of bank.

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METAL CONSTRUCTION

(*Continued from page* 45)

Another strong argument was that the welded fuselage lent itself to better production methods, and in the form of a truss without wires needed no further re-alignment or tightening up of turnbuckles, once constructed. For these reasons the welded tube fuselage swept the country. When the first Travel Airs Wacos, etc., were built (the first commercial ships built in this country under anything like production methods) they were all tubular fuselage designs, and this practice remained predominant for many years.

Another fortunate impulse towards metallization was found in the fact that the Army had after the war a large stock of stick and wire DH4's on hand. When these were to be overhauled and re-conditioned, considerations of price and production secured for the Boeing Company, Army permission to substitute the metal tubing in the fuselage.

Inevitable Metallization

As late as April, 1927, Colonel V. E. Clark in a paper before the A.S.M.E. stated—"Our fuselage structures are tubular, usually welded seamless steel, but sometimes duralumin. Our wing spars are usually of spruce, and our covering of doped cotton. But even up to 1927, when we were adhering for the most part to wooden wings and tubular fuselages, metallization had been definitely in process for several years.

Apart from the tubular welded fuselage, the ribs were probably the first elements to be metallized. This was done by using stamped sheet metal ribs for small sizes, and built-up framed ribs in the larger sizes. Saving in weight was not the initial reason for the movement, but rather impatience with the slow and uncertain process of gluing and nailing up small pieces of wood.

When building spruce spars in fairly large sizes, rejections sometimes ran as high as 50%. It was difficult to find in sufficient quantities spruce of the right slope, freedom from knots, etc. With encouragement from the Army and Navy, spars were accordingly developed in dozens of different types, including the welded steel truss spars, the stamped dural box, extruded dural I-beams and high-strength alloy-steel strip spars.

Because tail surfaces are in the slipstream of the propeller and subject to dust and gravel thrown up by it, constructors almost inevitably used metal covering over the tail surfaces. And if metal covering over the tail surfaces, why not over the ailerons?

The bottoms of wooden hulls suffered severely on impact with the water, on striking logs, etc. Therefore, Loening used a metal bottom. Since wooden hulls become partially water logged, (which adds greatly to their weight) constructors took to the construction of metal hulls.

Even when stick and wire fuselages were employed as in the old DH4's, the engine cowling was inevitably of metal. When the DH4's were used by the Post Office, the metal cowling was extended to take in the mail compartment as a measure of fire protection. But the application of metal covering without real connection to the structure of the fuselage, added weight without strength. Constructors remembered, also, the splendid results obtained during the war at McCook Field with monocoque fuselages of plywood construction, which proved lighter and stronger than the similar stick and wire jobs. Designers of military aircraft took cognizance of the fact that a metal monocoque fuselage would be less vulnerable to gun-fire. So there were many factors driving towards a metal covered fuselage.

As cantilever monoplanes became popular, it was found that wing torsion became an important problem, and with higher speeds, flutter appeared. Covering and recovering of the wings in scheduled airplane operation soon proved to be an intolerable nuisance. So many factors combined to force metal covered wings.

We see, therefore, that it was not the search for lighter weight which led to metallization. It was a combination of other factors which made metallization inevitable.

From 1922 Onwards

While we lagged behind after the war it was not for long. The Army and Navy began to issue specifications for all-metal (dural structures) and the Aluminum Company of America to produce dural sheets, tubes, rivets, etc. In 1922, Glenn L. Martin built the Navy UO-1 observation airplane, almost entirely of dural semi-monocoque, and the Army single-seater pursuit was entirely of metal except for veneer wing covering. The formation of the Stout Metal Airplane Co., was significant.

The year 1923 saw the construction of one of the first American metal hulls in the Aeromarine Naval AMC in which dural was used throughout. The industry was also fortunate in this year because Charles Ward Hall turned his attention from structural engineering to aeronautics, and made tremendous advances in the art—with what appeared to be a startling discovery that long columns in dural were lighter than equivalent long columns in steel.

Once metallization got under way, it never ceased even though its progress was checkered.

An exact chronology is impossible.

These things stand out most prominently:

(1) The Army and Navy continued for many years to place production orders with wooden wings, but never ceased to place experimental orders in metal both for complete machines and for spars, ribs, etc.

(2) Stout has the credit, probably, of building, in 1923, the first metal covered commercial machine in the United States.

(3) Charles Ward Hall, and the Aluminum Co. of America, working closely together for many years, produced ever better sections in dural, their association beginning in 1926.

(4) Horace Knerr taught us how to heat treat long steel spars of chrome-molybdenum.

(5) The Ford tri-motor, all-metal, gave American air transport tremendous assistance.

(6) Hamilton Metal Airplane Co., The Pittsburgh Metal Airplane Co., Metal Aircraft Corporation of Cincinnati, pioneered metal covering about 1927-30, when larger companies were hesitant in adopting it.

(7) Fleetwings skillfully pioneered from 1926 onward in developing stainless steel for aircraft use. We all know what Budd Manufacturing Co. did in this field, their work culminating in 1931 in the metallization of the Savoia-Marchetti.

(8) The effort of Northrop, Boeing, Douglas, in the final effort of metallization, beginning about 1931-32, is something which will always be remembered.

If our designers came several years after their European confrères in the use of metal covering for wings, they were perhaps the first to realize the full possibilities of true monocoque construction for wings. As early as March 1930, we find that Wellwood E. Beall, (of the Walter M. Murphy Co.) in an A.S.M.E. paper definitely advocating this idea. "The problem seems to be whether the structure should consist of a skeleton framework which carries the loads, and covered with a skin that merely makes the form of the ship, or whether this skin should be made to do double duty and also carry the loads, eliminating the skeleton framework . . ."

"Since a skeleton structure is a series of stressed members joined with a series of bulky joints and connections, it will run into more weight than will a single unit structure where there is no multiciplicity of joints, and where the stressed material is further away from the neutral axis and consequently does more work. In other words, a monocoque structure will show up more favorably in a strength-comparison."

While the Murphy company never got far in actual construction, it was perhaps the first energetic advocate of the monocoque wing, and influenced other California designers, ultimately to the benefit of the entire country.

Strange to say, one of the strongest impulses towards monocoque metal wing, came from Upson's design of the Metalclad airship. Thus, at the same March 1930 meeting of Upson's Associates, H. V. Thadden (constructing planes with the Pittsburgh Metal Airplane Co.) advocated and employed the "Monolithic" or single piece construction, pointing out in particular the immunity to bullet holes of that type.

We can say that 1929-30 marked the beginnings of the pure monocoque or shell type wing.

We need hardly recall to our readers what has been done more recently in the use of stressed skin.

Summarizing, we see that metallization of the airplane was the inevitable results of many causes, with lighter construction almost a subsidiary factor.

Today there can be no further argument on the topic Metal vs. Wood. It is only a question of time when even small commercial airplanes will be built entirely of metal, overcoming the great obstacle of somewhat greater cost in limited construction.

The technical problems that are now important are:

(1) Should metal covered fuselages be of the semi-monocoque type with bulkheads, and stringers or longitudinals to reinforce the skin; or should they be pure monocoque with a somewhat thicker skin and bulkheads only?

(2) Should wings retain the conventional and effective two-spar construction, with a smooth skin providing resistance only to drag and torsion; or should conventional spars be used with a corrugated internal skin and a smooth cover so as to take up bending loads also; or should the shell form of wing be adopted with spars eliminated, and a multitude of light stringers and webs to help the skin to work?

(3) Should we work on the principle of strong stringers, light skin; or negligible stringers and heavy skin?

(4) Should bulkheads or ribs be spaced at wide intervals, with other members stronger; or should bulkheads come at frequent intervals with other members of smaller sizes?

(5) Where metal structure without metal covering is employed, shot welded stainless steel can probably give quite as good an account of itself as aluminum alloy from a weight-standpoint. Where metal covering is employed, dural may show up somewhat better.

(6) Will the splendid methods of shot welding stainless steel developed in recent years prove so much cheaper than riveting aluminum alloy as to threaten the latter process, or will a process of welding strong aluminum alloys become entirely practicable?

(7) Should methods of connection other than those of shot welding be attempted on stainless steel?

(8) Is it worth considering interior construction of stainless steel with covering of light aluminum alloy?

(9) How will the problem of rigidity of fittings be really solved in monocoque construction?

(10) Many laboratories are now at work in attempts to reduce the cost of beryllium. Will they be able to reduce its cost so much as to allow the employment of this remarkable material in aircraft, with revolutionary effects on structural weight?

These and similar questions will only be answered by practice and experience.

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FABRICS AND DOPES

(*Continued from page* 39)

per square yard; the total weight of the dope film should be about 4 ounces per square yard. Gloss coats of lacquer or varnish are sometimes applied. The use of varnish over the dope film is objectionable, however, because it is difficult to remove if patching becomes necessary.

Fabric doped with cellulose nitrate now generally used in this country on airplanes is very flammable and its replacement by a less hazardous product is desirable. The statement made in an aeronautical journal recently that the flammability of cellulose nitrate is "a point more of academic interest than one which constitutes a real danger" (5), is astounding, in view of the fact that a number of airplane fires have occurred during the past few months in which the rapid spread of flames over the nitrate doped fabric was a vital factor in the resultant loss of valuable equipment. The attitude of the wartime aeronautical engineers toward the fire hazard of cellulose nitrate dope is well summarized in the following statement (6): "The great outstanding difference between the coatings given by cellulose acetate and cellulose nitrate is the inflammability of the latter, a difference which will probably be emphasized more and more as the use of airplanes for peaceful purposes increases. It seems to me only a matter of time when the users of airplanes in this country will demand that every possible factor of safety be taken advantage of, which will mean the use of non-inflammable dope." Inasmuch as for small airplanes the factors of weight, expense, and ready repair favor the use of fabric construction, a satisfactory nonflammable material should be made available for this purpose.

Cellulose acetate dope yields a coated fabric which has a comparatively high ignition temperature and is slow burning. By impregnating the cloth with fire-retarding salts a doped product can be obtained which will not burn under ordinary conditions (7). Two objections to the use of cellulose acetate dope have been raised. One is the higher cost, amounting to 50 to 100 percent more than cellulose nitrate dope. When it is considered that the cost of the dope is a small percentage of the total cost of an airplane, this difference in price of the two dopes becomes insignificant as compared with the potential loss resulting from the destruction of the airplane by the accidental ignition of the fabric doped with the very flammable cellulose nitrate.

The second objection is that cellulose acetate temporarily loses its tautness when it is continuously exposed to a humid atmosphere. One report states that the most serious slackness visible in wet weather is always to be found on flaps and elevators rather than main planes, and is certainly largely due to actual distortion of the structure upon which the fabric is stretched" (8). Inasmuch as cellulose acetate has a greater initial tautening effect than cellulose nitrate (9), this distortion may be relieved by more effective plasticization of the film. Other investigators indicate that the chief difficulty is encountered by moisture absorbed from the air rather than by actual contact with water, for "when the doped fabric is thoroughly saturated either by heavy dew or by rain, the whole becomes taut again, for now the contraction of the fabric is able to overcome the expansion of the dope" (10).

It should be noted that the foregoing observations relate to acetate dope used during the war, and that the problem is one of dimensional change rather than weight increase, since the actual amount of moisture absorbed has been shown to be very small (11). It may be that dope made with the improved grade of cellulose acetate available to-day and containing non-hygroscopic high boiling solvents and plasticizers will not present the temporary slackening effect mentioned above. Certainly the continued use of the less hazardous acetate dope by some countries indicates that satisfactory performance can be obtained with such dope. There are other relatively nonflammable cellulose esters on the market, such as the mixed cellulose acetate-butyrate ester, which are claimed by their manufacturers to have a high degree of resistance to moisture.

It is recognized that the adoption of new types of dope for airplane coverings is necessarily a slow process, since it must be preceded by thorough performance trials to eliminate faults arising from lack of experience in formulation and application. However, a demand for satisfactory nonflammable dopes would stimulate their commercial development.

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(6) Esselen, G.J., Jr., Ind. Eng. Chem. *10*, 135 (1918).

(7) Kline, G.M., Ind. Eng. Chem. *27*, 556 (1935); Natl. Bur. Standards J. Research *14*, 575 (1935); RP 788.

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(10) Atkins, W.R.G. and Barr, G., Gt. Brit. Adv. Comm. Aeron. Repts. & Memo. No. 318 (1917).

(11) Kline, G.M., Natl. Bur. Standards J. Research *14*, 67 (1935); RP 758.

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PERSONAIRLITIES

(*Continued from page 20*)

rides—any kind of a ride you like. It's a long ride for $5.00 and a short ride for $2.50." It certainly was a short ride—four passengers in a Hisso Standard, in, up, down, and out in less than a minute! They had a strong roustabout to hurl the passengers in at one side, and an even stronger one to haul them out on the other side the second the ship landed. Meanwhile the next group were being tossed in from the entering side. No safety belts, of course, and if they paid for a loop, a loop they got—and hold on for dear life, praying fervently! It was rough and ready aviation, the only specimen of its kind in the country. But they never lost a passenger. No ocean steamship line can say as much. Efferson, bawling his spiel and selling tickets by the hundreds, would stuff his pockets full of money, then thrust the bills inside his shirt. Back at the hotel room he would strip, and three or four thousand dollars would roll out. He is the only wing walker in the world who has ever been rolling in money!

The Circus performers, pilots and stunt men, drew no salaries, but got expense money whenever they asked for it. At the end of the year, or when anyone left, they were paid off. Jack Ashcraft made $22,000 one year, over and above all living expenses. Bill Brooks made over $2,000 net a month, and kicked because it wasn't more! The flood of wealth rolled in, and prosperity was regarded as a permanent condition; it was obvious that the mad whirl would go on forever, like the 1929 stock market. Pangborn usually carried $12,000 or more around in a suitcase which was never even locked; it was tossed into an automobile with the other baggage when the Circus moved. Not a dollar ever was stolen. Money was merely something to be carried along and used when required, like spares.

They were an honest, care-free, happy, fearless group of romantic adventurers, taking life as they found it and almost invariably finding it good. Life was to be lived, courageously, carelessly, with never a thought of the morrow. Of course, it wasn't commercial aviation; it was circus business. To-day it is a thing of the past. Airplanes now are as commonplace as automobiles, though not yet as numerous; and the majority of pilots are serious business men or sportsmen, or members of the American Federation of Labor, listening devoutly, like members of the Plasterers' Union, to words of financial wisdom from bumbling old William Green, or stern admonitions from the class-conscious Dave Behncke.

The Circus broke up in 1929, marking the passing of an era; there were municipal airports and flying fields everywhere, the fixed base operator was established and jealous of the Circus; and the days of barnstorming de luxe were over, never to return. Romance had given place to business, so Pangborn resolutely tried to adjust himself to changed conditions. From 1929 to 1930 he was Chief Pilot for the New Standard Aircraft Corp. and president of the New Standard Flying Service. Next year he took out the Flying Fleet Air Circus, and made some money. But it wasn't like the old days; American aviation's last frontier had become settled country. Pangborn knew now how the pioneer plainsmen felt when the thundering buffalo herds had vanished and only the bellow of steers and the plaintive bleat of sheep resounded on the plains of the old West. Pang would just about as soon herd sheep as herd an airplane back and forth like a metronome between New York and Chicago. He is an incurable romantic.

In July, 1931, Pang attempted to break the round-the-world record in a Bellanca with P&W Wasp and Hugh Herndon. Pang was Chief Pilot and navigator. They took off for Moscow, like the Roosevelt Administration's Soviet trade ambitions, but had to land in Wales—the Administration's ambitions landed in oblivion! Various delays forced them to give up the record attempt, but they continued via Siberia to Japan, where they were tossed into the hoosegow for flying over fortified areas. Not being able to prove that the two Americans were spies—or that they weren't!—the Japanese called it a day, let them out of jail, and gave them ten days in which to get out of the country and not come back. So they made the first non-stop crossing of the Pacific by airplane, starting Oct. 4, 1931, and landing 41 hours 10 minutes later in Wenatchee, Washington, a distance of 4,742 miles from Japan. The distance covered was about 5,300 miles, counting back-tracking to Wenatchee.

Clyde celebrated his return to the land of the more or less free by buying a nice shiny 16-cylinder Marmon automobile, only to discover at the end of a year that the large cavity in our national happiness slightly referred to as the "depression" was just getting a good hold on us. So in some mental turmoil he sold that nice shiny Marmon, which had cost him over $5,000 to own for one year, counting depreciation. And most of the year it had merely stood out in front of the hotel for the admiration of passersby and visiting pilots, who were always awed by it.

Pang's latest exploit was to fly in the famous MacRobertson Race from England to Australia as pilot and navigator for Roscoe Turner, the pride of Mississippi, in a Boeing 247-D, finishing in third place. They might have finished second if Pang had been able to keep awake all the time; for it was on the two occasions when Roscoe was piloting and Clyde was sleeping that they got off the course, losing 5½ hours of precious time. Roscoe knows the run from Los Angeles to New York by heart; but that's only an interurban bus ride compared to the London-Melbourne route where you have to believe your compass for about 12,000 miles, which by Roscoe's admission he was reluctant to do at times. You see, Roscoe has lived so long in California that he has come to suspect that even compasses must be damn liars, too.

Pangborn's latest romantic ambition is to fly non-stop around the world in pursuit of fame and fortune. It will be a startling and interesting trick if he can do it. I wish him all the luck in the world, for he's undoubtedly going to need it. Right now he figures that the financing is the hardest part of the flight. Once that is completed and the refueling planes arranged for, the mere flying his special Burnelli plane around the world will be child's play to an old circus performer who has put in more than 14,000 hours on the flying trapeze, many of them upside-down. For the life of the Gates Circus, nine years, he made a daily upside-down exhibition, so in the aggregate he probably has flown more miles in that position than has any other pilot. He was the first one to be named Upsidedown. This was long before the days of the Roosevelt New Deal, all of which was worked out by inverted college professors. It has taken the U. S. Supreme Court to turn some of them right side up again.

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GREY'S AIRWAYS BLUFF

(*Continued from page* 18)

cluding the other two Comets! But we really have a few other fast ships. There's the Vultee, for instance, which Bowen Air Lines, Inc., is using on their Fort Worth-Brownsville run, 567 miles in 3':50" block-to-block, 162 m.p.h. Northbound and 147.93 Southbound. Between Fort Worth, Dallas, and Houston, 271 miles, they knock off a block-to-block speed of 154.86 Westbound, and 180.67 Eastbound. The BBS is 158.37.

Northwest Airlines' Lockheed Electras fly the 1,907 miles between Seattle and Chicago, via Milwaukee, at a speed of 154.63 Eastbound, and 139.53 Westbound, block-to-block. A few old Hamiltons are still used on the short Pembina-Fargo feeder line, 149 miles, at a block-to-block speed of 105.15. This brings the system's BBS down to 147.98. On the Brownsville-Dallas run of Braniff Airways, Inc., the Electras are cruised at a block-to-block speed of 143.73 Northbound, and 137.98 Southbound for the 563 miles.

The Condor Sleepers of American Airlines fly the 1,320 miles between Los Angeles and Fort Worth in a block-to-block time of 10':10", 129.28 m.p.h. Westbound, and 137.74 m.p.h. Eastbound, time 9':35". The Dallas-Cleveland Condor Sleepers cruise the 1,103 miles: Eastbound 8':35", speed 128.51; Westbound, 9':18", speed 118.60. American's Vultees fly the Dallas-Chicago run of 914 miles in 4':57" Northbound, and 5':48" Southbound, at block-to-block speeds of 184.65 and 157.59 m.p.h. respectively. American's BBS is 134.58, due to the use of several U-Stinsons on the Cleveland-Boston run, which have block-to-block times of only 95 m.p.h.—nearly as slow as the Imperial Airways London-Paris service, using fine large English transports with built-in head-winds.

I haven't had my full say but I've already overstayed my space allotment and must make way for an advertisement of some of our American transport airplanes, the world's finest and fastest, bar none. I shall revert to this subject at a later date, because I'm very much interested in English aeroplanes, having kept and raced turtles when I was a boy. After writing about these fast American ships it will be very restful to doze along with an article about the nice English aeroplanes, built largely of wood and high hopes, assisted by the propaganda of dear old C. G. "Woof-Woof" Grey. I'll have to get around to the deplorable state of affairs in Australia, a subject colony of the British aircraft trade, where they have to buy British aeroplanes, or walk, the poor fellows. And I want to talk about the excellent Northrop, and the DH *Comet*, which is the nearest approach to perpetual motion yet invented; because on the basis of one good flight the Editor of the *Aeroplane* has kept it constantly in motion in his pages ever since. When they redesign it for commercial use on an airline—if they ever do—it won't be competition: It will be just another wooden airplane. At present it's a sardine box, and good only for racing. I mention it only because C.G.G. had the audacity to compare it to a Northrop. The *effrontery* of him! The old Grey mare ain't what she used to be!

ALUMINUM IN AIRCRAFT

(*Continued from page* 31)

after the World War) aluminum alloys were used in the construction of aircraft engines. In fact, it is generally conceded that the modern aircraft power plant would not have reached its present high efficiency and low weight-horsepower ratio without the development of reliable heat-treated aluminum alloy castings and forgings.

Before and during the World War and the years immediately following, wood propellers were in common use. With the development of heat-treated aluminum alloy forgings and the correct technique for the manufacture of forged propellers, the light alloy propeller came into almost universal use. With the strong aluminum alloy propellers, the aircraft operator is able to make efficient use of higher powered engines. Because of the ductility of aluminum alloy propellers, in case of accident they will often bend but not break and may be subsequently straightened and otherwise repaired and then returned to active service.

Later developments in forged aircraft products include forged crankcases, nose pieces and pistons, which are coming into common use in the higher powered aircraft engines.

Mechanical Properties of Cast and Forged Aluminum Alloys

Material	Tensile Strength (lbs./sq. in)	Yield Strength (lbs./sq. in)	Elongation (% in 2")
	Sand Casting		
109	24,000	18,000	1.5
112	22,000	14,000	2.0
122	25,000	21,000	0.5
142(Y)	28,000	24,000	1.0
*195-T4	31,000	16,000	8.0
*195-T6	36,000	22,000	4.0
*195-T62	40,000	27,000	2.0
*355-T4	30,000	20,000	5.0
*355-T6	35,000	27,000	3.0
*A-355-T51	28,000	24,000	1.5
	Forging		
*17S-T	58,000	35,000	20.0
*18S-T	55,000	35,000	10.0
*25S-T	58,000	35,000	18.0
*32S-T	53,000	43,000	7.0
*51S-T	48,000	38,000	14.0

**Indicates heat-treatment.*

It is, indeed, a far cry from the flimsy planes of the early days of flying to the all-metal transports of our leading airlines. With strong aluminum alloys of inherently high corrosion resistance, such as the Alclad materials, which can be safely used without shop-priming and painting for many parts of aircraft, and with electric resistance welding coming into more general use, not to mention new alloys and processes still in the development stage, there is every prospect for more economical, safer and more satisfactory aluminum alloy aircraft in the future.

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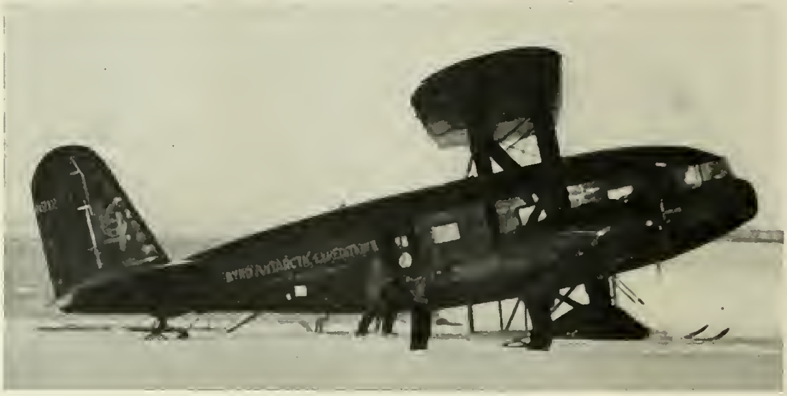

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FAIRCHILD MODEL 42: 4-place cabin ship in excellent condition. Wright J6-9E engine, 178 hours since major, 578 hours total time. Price $1,750. Airplane Development Corp., 1044 Airway Drive, Glendale, California.

SZEKELY BUHL PUP: $385. Total time 370 hours. Recent major. Ship and motor in good, clean condition. Licensed February '36. Paul Souder, Gahanna, Ohio.

CHALLENGER ROBIN: 185 h.p., total time 300 hours, 10 hours since major overhaul; licensed to June 1936. $975. R. G. Schmitt, St. Louis, Missouri.

COMMAND-AIRE OX-5: Recovered, relicensed, $575. Cirrus motor, steel prop, $250 or will buy ship that will take Cirrus motor. Dan W. Bryan, 706 Jackson St., Durham, North Carolina.

STEARMAN J-5: Perfect condition. 530 honest hours. Recently overhauled. Privately owned. Two instrument boards, complete. Twelve-inch diameter semi-balloons. Owner going to Europe. Sacrifice. Further information, photographs. Lost Nation Airport, Willoughby, Ohio.

STINSON MODEL S: Good condition, licensed November 1935. Will sacrifice for $1,250 cash. No trades, no terms. Ship worth much more. Full details on request. W. O. Britt, Jr., Thomaston, Georgia.

GEE BEE BIPLANE: Kinner K-5, studded beads; collector ring, air starter, brakes, side-by-side dual controls, releasable in flight; ideal for instruction, never cracked, good condition. Twenty hours since major; bargain, $900. F. S. Osgood, 216 Tremont Street, Boston, Massachusetts.

LOENING AIR YACHT: 7-place; 1100 pound payload. Wasp "C" motor, original sized cylinders. Licensed last Fall. Real bargain at $2,500. C. H. Pickup, Box 8925, West Palm Beach, Florida. F. E. Johnson, 1302 East 22nd St., Brooklyn, New York.

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KINNER BIRD: 3-place, new style beads, brakes, dual controls, recently overhauled and recovered; always hangared; extra fine condition, almost like new; licensed to February 1936. $1,250. Dr. V. J. Gragg, Clanton, Alabama.

FOR SALE: Speedwing Travel Air B-4000; licensed, J-5, Hamilton steel propeller, 50 since complete overhaul; has compass and clock plus regular instruments and air speed; dual controls, oleo-air shock absorbers, radio shielded throughout; night flying equipped, less landing lights; brakes and tail wheel; top speed 125; 64-gallon gasoline capacity. Previously owned by the Department of Commerce. First cash offer $1,500 takes airplane. Write Graydon Withey, 206 Dryden Building, Flint, Michigan. Phone: Flint 2-4325.

J-6 ROBIN: Bank and turn, rate of climb, Heywood starter, navigation lights, tail wheel; chromium exhaust ring; Exide battery, New Bendix wheels and brakes. Cabin relined red Spanish leather, color orange and black. 5 hours since motor overhaul and prop recondition; total time 275 hours. Always hangared; condition perfect; licensed to November. Cruises 100 at 1650; positively finest Robin in country. Must be seen to be appreciated. $1,200. Cash, no trades. David Simonton, Elkhart, Indiana.

J-5 STINSON: Licensed July 1936; equipped for night flying. Sell or take lighter ship on trade. Sam Baksbas, Box 303, Fort Peck, Montana.

FOR SALE: 1 Lincoln PT with radial motor; 1 Taylor Cub with Continental A-40 motor; 1 Monocoupe with Velie motor. All ships in perfect condition and licensed. Priced to sell. Apply Pottstown Airport, Pottstown, Pennsylvania.

AERONCA C-2: Recovered, new Fahlin propeller, wired; excellent condition. Sacrifice for best offer over $400. Robert Gettelman, 5804 Elliott Circle, Milwaukee, Wisconsin.

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BEAUTIFUL RYAN SPEEDSTER: Three-place, open cockpit; J6-5 motor. Ship like new. NC license expires June 1936. Walter Schneider, 5032 Hurlbut, Detroit, Michigan.

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LOCKHEEDS: 2 Orions, manufactured 1934. Wing flaps, two-way radio, all Sperry instruments, S-1-D-1 engines, controllable pitch propellers. Cost new, $32,000. Specially priced, $12,500. Vegas, Wasp engines, $5,500 to $7,000. Babb, 1100 Airway, Glendale, California.

KEYSTONE LOENING COMMUTER: In A-1 condition (40 hours since new). "D" type J6-300 with 17 hours since major overhaul; full set Pioneer instruments; NC licensed. For further information or inspection: Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Penna.

MUST SELL, LESS MOTOR: 6-place Stinson cabin ship, NC licensed, beautiful condition, new Airwheels, brakes. Less J-6 330 h.p. motor. Will accept good light air-cooled ship on deal. Michigan Aero Motors, Jackson, Michigan.

MONOCOUPE VELIE: Long Wing; licensed, motor good; always hangared; covering excellent. $575 cash. E. Versteeg, 710 South Menlo Ave., Sioux Falls, South Dakota.

RYAN 5-PLACE: New covering, overhauled completely. $1,350 cash. Werts Novelty Company, Muncie, Indiana.

SWALLOW OX-5: Motor and ship like new. $475, or light car and cash, or trade on closed ship. L. H. Foster, 807 Tradesmens Bank, Oklahoma City, Oklahoma.

FOR SALE: One J-5 Bellanca six-place, excellent condition, little over 200 hours since new; or will trade for Waco C, 165. Milton Hersherger, Put-in-Bay, Ohio.

J-6 ROBIN: Electric starter, tail wheel, brakes, steel propeller, new 12-volt battery; licensed to June, 1936; $1,000. Iowa Airways, Fort Dodge, Iowa.

LOW-WING HARPER monoplane: 36-foot wing span; powered by 45 h.p. Szekely motor. Three gallons gasoline per hour; dual controls. $600. H. E. Dutton, 206 W. Wayne, Butler, Pennsylvania.

WARNER 125 h.p. motor with Heywood starter and Hamilton metal propeller. 180 hours total time. Real bargain. D. Smith, 1493 Pingree, Detroit, Michigan.

1934 JACOBS-POWERED Cabin Wacos: Two for sale at most attractive prices. Both like new and guaranteed never to have been cracked. Jack Gillies, Aviation Country Club. Hicksville, L. I., New York.

EAGLEROCK A-3: 180 Hisso, Army overhaul. Total ship time 135 hours; engine 48 hours. Just relicensed, partly recovered, all refinished. Lights. L. Cameron, 1383 Gladys Avenue, Lakewood, Ohio.

LOCKHEED VEGA: Excellent condition throughout; white paint job like new, also maroon leather interior. P & W Wasp engine with new one-piece master bearing; total time only 140 hours. Special NACA cowl and wheel streamlines. Extra tanks and heavy duty landing gear also available, making this ship ideal for long distance flights. Art Goebel, Phillips Petroleum Co., Bartlesville, Oklahoma.

GEE BEE SPORTSTER: Warner motor, perfect condition, special job; contract for which purchased expired. Will trade on passenger ship. Boulevard Airport, Philadelphia, Pennsylvania.

J6-9 FORD TRIMOTOR: $4,750 for quick cash sale. Perfect throughout. Deliver anywhere. Licensed, 11 passengers. Latest model. Picture. Alton Walker, 600 Graphicarts Bldg., Kansas City, Missouri.

BUY PRIVATE OWNED AIRPLANES: Many like new. Waco C, $2,300. Loening Commuter, $2,200. Kinner Bird, $1,100. Waco F, $1,600. Aeronca 1-place with float, $650. J-5 Stinson, $1,200. Hisso Eaglerock, $650. Kinner Eagle, $875. Ox-5 airplanes, $350 up, many others. Write or wire for demonstration appointment. Pioneer, Airport, Syracuse, N. Y.

LINCOLN PTK: Blind flying trainer; Kinner 100 h.p. Both plane and motor in good condition. Complete blind flying equipment, including radio, flares; wired for landing lights. Many other extras. Increase your profits with Blind Flying instruction. Exceptional bargain at only $1,275. The H. C. Robbins Co., Cleveland Airport, Cleveland, Ohio.

KITTY HAWK: Kinner B-5 engine; total time 325 hours; good condition; $1,500 at DuPont Airport, Wilmington, Delaware.

TRAVEL AIR S-6000-B: 6PCLM; Wright D, 330 h.p., just overhauled; radio, landing lights, electric starter, generator, flares, etc. $3,200. Frank Ambrose, Inc., Municipal Airport No. 2, Jackson Heights, New York.

FOR SALE: Stinson SM8B, Wright J6-7; engine 100 hours since major; new wheels and brakes, leather upholstery, extra instruments. Licensed until March, 1936. Cash, $1,275. Moore Flying Service, Box 753, Dayton, Ohio.

BULL PUP: Medium wing, excellent condition. Motor majored about 60 hours ago. Airspeed, clock and standard instruments. $425. Peter Milton. 2127A So. 34th St., Milwaukee, Wisconsin.

OX-5 LAIRD SWALLOW: Good flying shape, $150. Ox-5 American Eagle, $150. Hisso Standard, $75. Will buy bargains. Leo Sparhawk, 407 Eighth St., Des Moines, Iowa.

DE LUXE WACO CABIN: 1934 model, Jacobs-powered, completely equipped. Also Fairchild 22 and Kinner Standard, excellent condition. Details on request. J. T. Moore, Jr., Reading, Pennsylvania.

AERONCA 1935: 3 months old, with heater, lights, compass, airspeed indicator. 70 hours total. Price $1,650. A. K. Luke, Jr., 1215 Fifth Avenue, New York, N. Y.

WRIGHT CYCLONE ENGINE: Model C; 525 h.p.; total time 130 hours; major overhauled by factory; no time since major. Will trade for airplane. Lawrence Smith, P. O. Box 111, Greenlawn, L. I., New York.

ALL-METAL CONSTRUCTED 6-place Cunningham-Hall. J6-9, majored 70 hours ago. Blind and night flying equipment. 11 x 12 airwheels, brakes. Photographic apertures. Cruises 115. $1,300. J. C. Mirguet, 449 Magnolia, Rochester, New York.

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STINSON SM8A: Newly recovered, motor rebuilt factory. Ring, pants, landing lights, flares, Lear radio, turn and bank, rate of climb. Beautiful ship, privately owned. Total time 450 hours. Price $2,200. C. J. McBride, 1411 Walnut St., Philadelphia, Pennsylvania.

J-5 WACO STRAIGHTWING: 455 hours, 120 since majored. Excellent condition; wings refinished; extra instruments; licensed May, 1936; $1,450. Also complete sign-towing equipment, interchangeable letters. Arthur St. John, 502 Schenectady St., Schenectady, New York.

WACO GXE: NC785E; OXX-6, just majored; new prop. Booster starter, standard instruments; never cracked. $450. No trades. Byron W. McCartney, Economy Oil Co., Joplin, Missouri.

LYCOMING STINSON SM8A: Low hours, excellent condition, always hangared, always privately owned. Goodyear balloons, electric starter, leather upholstery, ring, many extras. $1,750. S. L. Huey, Devils Lake, North Dakota.

ISN'T A J-5 IRELAND five-place open cockpit boat the most practical passenger-carrying water job? I've a good one for sale. R. Kenyon, 345 Linwood Ave., Newtonville, Mass.

J-5 TRAVEL AIR: New covering, 5 hours since major overhaul; custom finished in black trimmed in red and gold; instruments include airspeed, air temperature, fuel gauges, altimeter, clock, Kollsman sensitive altimeter, Daiher compass, rate of climb, turn and bank, and in front cockpit compass, airspeed, tachometer and altimeter. Full airwheels, brakes, speed ring, steel propeller and lights. E. P. Higbee, c/o Skyways, Inc., Cleveland, Ohio.

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BEST BUYS ON PAGE: Less motors: Kinner-powered 2-place side-by-side Red Arrow Simplex monoplane, less Kinner motor, $275. B-1 5-place Ryan cabin ship, Goodyear full Airwheels and brakes, air tail wheel, dual controls, $675 for quick sale, less J-5 motor. Michigan Aero Motors, Jackson, Michigan.

FIVE FOKKER A-F 10-A's: DeLuxe models. Completely reshingled and fuselages recovered. Three Wasp 420 h.p. engines; full instrument equipment. $1,950 to $3,500. Babh, 1100 Airway, Glendale, Calif.

STINSON S: Completely reconditioned and Lycoming engine major overhauled, with new heavy duty crankshaft installed. Ship completely refinished and in beautiful shape. For further information or inspection: Batil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Penna.

$1,250: STINSON 4-place cabin; J-5. New paint, cover, wheels, brakes, oleos, do-nut tires, tubes; 69 gallon gas capacity. Excellent condition, licensed. Also wrecked 201 American Eagle. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

FOR SALE: J-5 Stearman. Beautiful condition, complete night and blind flying equipment both cockpits, pyralin sliding rear cockpit, starter, generator, full balloons, steel propeller, tail wheel, 100 gallon gas tanks, $1,750. Austin Municipal Airport, Austin, Texas.

STINSON RELIANT: Like new, special upholstery, paint; landing and navigation lights, flares, large gas tanks, NACA cowling, pants, Lear radio. bank and turn, rate of climb; always hangared, privately owned; time, 108 hours. Real buy for cash. Wesley Airport, Wesley, Iowa.

FAIRCHILD KR-31: Modernized J6-5, two hours since top overhaul. Black fuselage, yellow wings. Will consider light plane in trade. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Penna.

STINSON RELIANT: Special paint, upholstery, full night equipment, radio, Kollsman altimeter, directional gyro, artificial horizon; condition A-1; taking delivery on new Stinson, must sell immediately. Boulevard Airport, Philadelphia, Pa.

WARNER WACO F: 450 hours, engine majored, ship in excellent condition. C-W Jr., just relicensed. Cheap. Want Heywood starter for Warner. Air Activities Airport, West Chicago, Illinois.

REARWIN JR.: Licensed, like new, $650. Velie Monocoupe, long wing, just relicensed, high finish, $565. Aeronca late single-place, tripod gear, motor overhauled, new covering, $430. Monty Barnes, 638 Pattie, Wichita, Kansas.

45 H.P. SZEKELY engine with new type crankcase, air wheels and all parts. Bull Pup at bargain price. Hambrick Electric Co., Fort Worth, Texas.

FRANKLIN SPORTSTER: Newly rebuilt and recovered. Licensed. Lambert 90, airwheels, instruments, oleos, compass, duals. Wonderful performer. $1,095 cash. Stephen Secunda, 354 Center Avenue, Butler, Pennsylvania.

KINNER ARROW SPORT: Excellent condition, just refinished and relicensed; airwheels and brakes; 300 hours. Challenger Rohin: Licensed till January, brand new Challenger engine. Will trade. Fred C. Valentin, Marion, Illinois.

ONE DE LUXE MODEL Demonstrator: 30 hours. One Standard Model factory rebuilt, 50 hours. Completely equipped with brakes, compass, air-speed and duals. Low cash prices. Write or wire Skylark Aircraft Corp., Muskegon Heights, Mich.

FORD TRIMOTOR FREIGHTER: $3,750; licensed; heavy load carrier; cruises 120; extra good condition through modernized J6-9 motors. Western Airplane Distributors, 934 Wyandotte, Kansas City, Missouri.

PRIVATEER AMPHIBION: Perfect condition, latest type; all white; bank and turn, rate of climb; prepared for radio. Continental 210; total time 420, 120 since major. Bargain at $2,500. Atwell-Barbin Aviation Corp., Hangar D, Roosevelt Field, Mineola, New York.

LICENSED OX-5 EAGLEROCK: $350. Transport pilot will teach purchaser to fly it, gasoline and oil furnished, board and room thrown in. Beat this offer if you can. Terms, half down, balance when you can fly ship. Terry Noll, Box 132, Bellefonte, Pennsylvania.

J-5 STANDARD: 5-place. Ideal barnstorming ship. Entire ship in good condition. Oversize tires, extra instruments. Attractive paint job. Will trade on Stinson, or $1,600 cash. Goodwill Air Service, Bernharts P. O., Pennsylvania.

FLEET: Late model 2; front exhaust Kinner, $1,250. Taylor Cub, 8 months old, $1,000. Both ships in excellent condition. Indiana Air Service, Bendix Municipal Airport, South Bend, Indiana.

OX-5 INTERNATIONAL: 3POLB. Identified but in good condition; $190. Also Hartzell propeller for Kinner or Warner, like new, $20. C. Muhlherger, Mount Healthy, Ohio.

LATE 45 SZEKELY EAGLET: 230 hours, majored, cover excellent, $435. Just relicensed. Curtiss Jr.: 45 Szekely, 160 hours, good condition, $100. Relicensed. Travel Air E-4000: 175 Wright. Fuselage and tail surfaces recovered, new control cables, etc. Motor has 10 hours since major. Total time 361 hours. $1,375. KR-34: 175 Wright. Ship perfect, semi-airwheels. Motor has 105 hours since major. Total time 487 hours. $1,285. Will consider trade late Aeronca, Fleet with brakes, D-25 Standard. Wilson Flying Service, New Kingston, Pa.

REBUILT AND RECOVERED OXX-6 3-place Bird. 2 Scintilla mags. A bargain at $650. Princeton Airport, Rocky Hill, N. J. Ask for booklet on our Flying Courses and solo time.

LAMBERT-POWERED stunt plane: Taper wings, NACA cowling, stressed, full instruments, tops 130. Replica of Curtiss P-1. 25 hours total time; excellent condition. Iowa Airways, Fort Dodge, Iowa.

STINSON RELIANT: Like new; total time on ship and engine, 225 hours; radio, blind flying instruments, many extras. Priced to sell. Fox Valley Motor Service, Inc., 260 South Highland Ave., Aurora, Illinois.

J-5 FAIRCHILD: Equipped with loudspeaking amplifier and all operating equipment including spare parts and patents; will demonstrate. The Sky-Ad Company, Municipal Airport, Cleveland, Ohio.

VELIE MONOCOUPE: Late type, air wheels, little time; $625. Lamhert Monocoupe: Like new, $1,200. Both ships just relicensed. Want 650 x 10 air wheel and tire. C. W. Siehl, Sherburn, Minn.

J-5 WACO: Starter, semi-air wheels, fuselage and lower wing recovered year ago. Licensed June, 1936. Aeromarine "Cub": $1050. Taylor Aircraft Company, Bradford, Pennsylvania.

STINSON SM8A LYCOMING: Perfect condition, semi-air wheels, engine cowling, new Exide battery, high gloss finish, always hangared, $1,600. Will accept Lambert Monocoupe in trade. Jack Friedman, 150-24 20th Avenue, Whitestone, L. I., New York.

PITCAIRN PA-3: OX-5 motor; both ship and motor in perfect condition, with almost new covering on wings; will sacrifice for $275, or will take small car in good condition as part payment. Will deliver free of charge within 200 miles. Melvin W. Younghlood, P. O. Box 625, Summerville, South Carolina.

MONOSPORT: WARNER 125; total hours 210; excellent; every instrument; licensed, $1,250. Challenger Rohin: Licensed, just topped; perfect; $1,000. Art Neujahr, Bagley, Minnesota.

LATE 210 WACO Cabin: Like new, night and blind flying instruments, many extras. May accept Waco F-3 in trade. Paul Peterson, 2503 Union Avenue, Altoona, Pennsylvania.

FOR SALE: Warner and Cirrus Fairchild 22's. Fairchild 24. Lambert and Warner Monocoupes. J6-9 open Travel Air. Bellanca Pacemaker, Bellanca Skyrocket. Lockheed Vega. Wasp Laird. Stinson S. Stinson Reliant. Waco F-2. J-5 Stearman. Challenger Rohin. Jacohs Beechcraft. Waco Cabin. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

J6-7 STEARMAN: Motor just overhauled and modernized. Ship is in excellent condition with many extras. J-5 motor, just overhauled; J6-5 motor, completely overhauled and modernized; reconditioned J-6 cylinders, magnetos, carburetors and other parts at reasonable prices. General Airmotive Corp., Municipal Airport, Cleveland, Ohio.

J6-9 TRAVEL AIR 6000B: $2,750. Latest 1931 model. Eight hours since complete recover and motor overhaul. Wonderful buy. Licensed June, 1936. Alton Walker, 600 Graphicarts Bldg., Kansas City, Missouri.

11 AIRPLANES FOR SALE OR TRADE: Stinson Sr., J6-9 six-place cabin; two J6-5 Travel Airs; two J-5 Straightwing Wacos; Kinner B-5 Waco F; two OX Travel Airs; OX Waco 10; LeBlond Arrow Sport; Heath Parasol powered with Wright Morehouse. Trade in your ship or will accept cars of late model. Terms if desirable. Two almost new white silk Irvin seat parachutes. Steel propellers for J-6 and J-5. Few new Hamilton wood propellers at $15. Flottorp, Marshall and Bennett propellers carried in stock for all motors. Write for details. Central Air Service, Grand Rapids, Michigan.

BUHL PUP: 210 hours total time; just recovered; needs slight repair to fuselage and propeller, $275 or $360 flyaway. OX-5 Lincoln Paige, 3POLB, licensed, ready to go, $360. J. W. Lytle, 2333 Vodeli St., Pittsburgh, Pennsylvania.

FAIRCHILD KR-21: Completely refinished and Kinner engine just majored. Relicensed till June, 1936. For further information or inspection: Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

J-5 EAGLEROCK: Motor and ship perfect, $1,200. Curtiss Challenger Fledgling, $800. Arrow Sport, speed ring, $550. One complete set Waco "9" wings, cheap. One used Hisso A motor, with radiator and motor mount, $40. Jamaica Sea Airport, Jamaica, L. I., New York.

WACO F-2: Continental, $2,750. Recovered, motor majored. $1,000 extras. Privately owned, little time, never cracked or stunted. Alton Walker, 600 Graphicarts Bldg., Kansas City, Mo.

WACO CABIN: '31 model. Continental 165 h.p., motor has just had major overhaul; plane just refinished; never cracked. Excellent condition. Act quick for real buy. The H. C. Rohbins Co., Cleveland Airport, Cleveland, Ohio.

WE BUY AND SELL airplanes; cash paid, quick action. Write or wire if you want to buy or sell. Demonstration and terms arranged. Pioneer Aviation, Airport, Syracuse, N. Y.

BELLANCA SKYROCKET: Travel Air 6000-B; Sikorsky S-39; Commuter; Warner Fleet; Challenger Eaglerock, etc. Parts for Sikorsky, Fairchild 71. Sperry Horizon, $175. Jaros, Flushing Airport, Flushing, L. I., New York.

ENGINES: Majored by approved agency. Hornet B, $1,500; Hornet A-1, $850; Wasp S-1-D-1, $2.500; Wasp C, $1,100; Wasp B, $750; J6-9-D, $950; J6-7 D, $750; J-5, $500; Warner 125 h.p., $475; Kinner K-5, $300; Lycoming 215 h.p., $575. Babb, 1100 Airway, Glendale, California.

FOR SALE: Avro Avian, perfect condition; always hangared. Cirrus powered, 130 hours total time. Chester Caldwell, R. D. No. 1, Stamford, Conn.

HUNDREDS OF AIRPLANES: $40 up. Crack-ups, motors, parachutes. Every location. Directory with owner's price, name and address. 20¢ postpaid. Used Aircraft Directory, Athens, Ohio.

WACO TEN OX-5: Scintilla magneto, $400. Command-Aire, 2POLB. Siemens-Halske, 113 h.p., $750. Both, licensed, duals and in good condition. Wanted: Waco F, F-2, or C. Write Bob Gilbert, Tamaqua, Pennsylvania.

KEYSTONE LOENING COMMUTER: J-6 motor, NC license. Must sell at once. $2.000 at West Palm Beach. "Bill" Walker, 721 43rd Street, West Palm Beach, Florida.

AVRO AVIAN: Licensed, Cirrus Mark III, like new throughout. Standard instruments, Hartzell prop, wing slots, folding wings; 235 hours total. Bargain at $675. Pair 22 x 10-4 Goodyear Airwheels and standard size adapters, fine condition, $65. George L. Eberly, Navarre, Ohio, Route No. 2.

GREAT LAKES: 2T1A. Licensed. Ship and motor in excellent condition, $800. Two Irvin pongee chutes, $50 each. Otto Johnson, Williamsburg, Va.

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SALMSON EAGLET: Identified. 200 hours on motor. Ship recently recovered. Always hangared and in good condition. $400. Hunter Goodwin, 1306 North 23rd Street, Richmond, Virginia.

STRAIGHT WING WACO: 175 h.p. Wright J-6; 15 hours since majored and modernized; electric starter; tail wheel; fuselage recovered, high lustre finish; a real buy, $1,250; will consider trade. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

NEW STANDARD J-5: Motor and ship just overhauled, $1,600. New D-25, finished to customer's specifications, with J-5, total time 30 hours, $2,000. We have purchased the New Standard factory and can supply parts for all models. A. L. Mathews, Schenectady Airport, Schenectady, New York.

J-5 PITCAIRN SPORT MAILWING: $1,150. 125 modernized Warner four-place Cessna, $1,000. D. H. Gypsy Moth, $550. OX, NC licensed, Robin, $350. Any airplane or car taken in trade on Taylor Cub. 12 months to pay the balance. Earl E. Bach, authorized dealer, Taylor Cub, Municipal Airport, Philadelphia, Pennsylvania.

PITCAIRN AUTOGIRO: Kinner, 125 h.p.; two-place. In excellent condition. Any reasonable offer or will trade for 3-place ship. AERO DIGEST, Box 2101.

ALEXANDER FLYABOUT: Only 170 hours; excellent condition; always hangared. Airspeed, compass, navigation lights and other extras. Just top overhauled and relicensed. At Teterboro. Bargain at $525. O. W. Towner, 180 Varick Street, New York, N. Y.

STINSON S: Motor factory modernized; ring, new tires, flares, landing lights, licensed; last major 75 hours; ship, motor perfect. $2,200. Walter Finley, 6068 Sixteenth, Detroit, Michigan.

DE LUXE "UIC" Continental cabin Waco: Motor majored at factory 5 hours ago. New type master rod. Special paint, air starter, air brakes, turn and bank, rate of climb, Western Electric 17A radio with two special headsets, 70 gallon tanks. Total hours, 308. A bargain. Hadley Aircraft, Inc., Hadley Airport, New Brunswick, New Jersey.

KINNER AMERICAN EAGLE in splendid condition. Licensed to April 1936. For quick sale, $695. Terms to responsible party. Johnson Wright, Box 1551, Miami, Florida.

FOR SALE: Great Lakes in perfect condition, newly recovered; brand new Cirrus motor; just licensed; a bargain at $950 or will trade for Fairchild cabin in good condition. Nat Krasnoff, 8763 Third Avenue, Brooklyn, N. Y. ATlantic 5-5035.

THE FINEST SELECTION of used planes we have ever offered. Kinner K-5 Fleet; J-5 Travel Air; 2 OX-5 Wacos; OX-5 Travel Air; OXX-6 American Eagle; Salmson Eaglet; Porterfield Demonstrator; Taylor Cub Demonstrator. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

HISSO E TRAVEL AIR: Tail wheel, brakes, extra instruments. Motor no time since overhaul. New tires. Covering excellent. Steel prop. Licensed to 1936. $875. Little-Greiner Flying Service, Springfield, Ohio.

KINNER TRAVEL AIR 4000: Steel propeller, airwheels, brakes, 270 hours, excellent condition, blue and silver, $950. Will take trade-in. Foster A. Lane, Port Columbus, Columbus, Ohio.

FLEDGLING: CHALLENGER motor; good condition, licensed to February 15, 1936. Always hangared. Near New York City. Cash, or trade for 3- or 4-place ship. AERO DIGEST, Box 2102.

MONOPREP: Velie M-5; fully equipped. Ship and motor overhauled, new license, snappy sport or training ship. Low maintenance. $650. Pioneer Aviation Co., Syracuse, N. Y.

NEW STANDARD TRAINER: Kinner 100 h.p. Just had major overhaul. Airwheels. For quick sale, $950. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

AERONCA SEAPLANE: C-2 Scout; 225 hours total; perfect shape; $650 with floats and wheels. K. P. Wilson, Dearborn Place, Ithaca, New York.

TRAVEL AIR OXX-6: Ship and motor completely majored 550. J-5 P-6 Pitcairn and Fairchild KR-34D, completely recovered; motor and ships equal to new. Priced for a quick sale. Pioneer Aircraft, Teterboro Airport, Hasbrouck Heights, N. J.

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WARNER STINSON cabin: Looks like new; interior finished in blue velour; fully equipped; landing lights, brakes, etc. $850. Terms arranged. Wonderful bargain. Pioneer Aviation Airport, Syracuse, New York.

FOR SALE OR TRADE: Eleven excellent airplanes. 1934 Waco demonstrator. Kinner Bird. Eastman Boat, 180 hours total. J-6 330 Laird. J-5 Waco. J-5 Eaglerock, equipped for blind flying instruction. Great Lakes, 400 hours. OX-5 Waco. Warner Ireland Sport. Verville Trainer. 1934 Stinson Reliant, radio. P. C. Beckman, 15040 Ferguson, Detroit, Michigan.

TAYLOR CUB with hangar: A-1 condition, with compass, new type motor A-40-2 Continental, and enclosure, etc. Hangar: Assembled and portable. D. Edgar Miller, Mahaffey, Penna.

SPECIAL HIGH PERFORMANCE photographic ship: Cruising speed 125 at 20,000 feet. Special mount for Fairchild 5 lens camera. Wasp B. major overhauled. Ship relicensed. Six seats in soundproofed cabin. A. C. Bussy, care Fairchild Aircraft Corp., Hagerstown, Maryland.

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THADEN ALL METAL 140 m.p.h. 5-place cabin; 575 hours; J6-9. Cost new, 1931, $13,000. Ship in excellent condition. Hamilton propeller, speed ring, navigation lights, blind flying instruments. Climbs 1,000 feet per minute. Can be bought with or without 100-watt sound system. $2,500 for all. Trades accepted. Howard Wyckoff, Ovid, N. Y.

AVRO AVIAN: Cirrus-powered, total time 225. Three hangar ramps. A real buy for $350. AERO DIGEST, Box 2106.

LAIRD SPEEDWING: Deluxe model, Wasp Jr. 400 engine; has top speed 180 m.p.h. A beautiful ship at a bargain. Write for complete list of used planes. E. M. Laird Airplane Company, 5301 West 65th Street, Chicago, Illinois.

SELL OR TRADE: Licensed Eaglet; propeller, covering, airwheels all new. High gloss finish. Motor majored. Want J-5 job with or without motor. B. Fairchild, care The Palace, Monroe, Louisiana.

FOR SALE: 1934 Continental cabin Waco. Excellent condition; new wood propeller; electric starter; battery, landing lights, air brakes and 70-gallon tanks. Engine shielded for radio. Airplane bonded for radio transmitter. Engine just completely overhauled and modernized, with salt-cooled valves and improved master rod bearings. $4,200 at DuPont Airport, Wilmington, Delaware.

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AMERICAN EAGLE: Long nose, Kinner K-5, licensed till May 15, 1936; steel propeller, DH wheels, excellent condition, $650. Harold Patch, Alden, New York.

OX WACO 10: Splendid condition; top overhaul just completed; $375. Real bargain. Joseph Schiavone, 581 Vanderbilt Avenue, Brooklyn, N. Y., or Hangar 3, Floyd Bennett Field.

3000 TRAVEL AIR: Curtiss C-6 motor; time—ship 320 hours, motor 100 hours. Licensed till June 1, 1936. Airwheels, brakes and metal propeller. Price $1,050. For full description write E. G. Ashbaugh, Box 1, Harrison City, Pennsylvania.

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AERONCA 1934: Excellent condition; brakes, enclosure, lights; 258 hours. A bargain at $1,290. United Aero Corp., P. O. Box 222, San Antonio, Texas.

AERONCA C-3: One year old; total time 160 hours. Waco GXE, OXX-6, perfect condition, for sale or trade. Clark Flying Service, Raven Rock Airport, Portsmouth, Ohio.

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IF IT FLIES WE HAVE IT: Weather-proof Navy flying suits with zippers front and legs (cost $20), $3.75. 10 x 3, 500 x 3, 500 x 4, 14 x 3 tire and tube, $5; wheels, $3.50. 24 x 4, 26 x 3-4-5, 28 x 4 straight side non-skid tire, $3.50 each. Larger sizes, $5 each. All sizes wheels, from $1 to $3 each. Standard steel propellers, all sizes, $50 to $150. Variable pitch Hamilton propeller, best offer. Motors and parts for Wright Cyclone Model R-1820 F. Wasp, Hornet, Liberty, Hissos, OX-5, OXX-6, Hall Scott, Mercedes, Whirlwind and other makes of air-cooled motors. New Siemens-Halske 5-cylinder radial motor in original crates, 70 h.p., $250. New B. G. 4-B spark plugs, 50¢; AC, Champion, Splitdorf, 25¢. Motor generators, 10 volts input, 300 volts output, $10. New Fahrenheit temperature gauges, 12', $1.90. 3½" dial new altimeters, $3. Bank and turn and rate climb indicators, new, $40. Tachometers, $7.50. GE compass, $5. Oil and fuel gauges, $1 each. B 2-3-4 engine throttles, $2 to $3.50. Engine primers, choke controls, 50¢. Scintilla, Bosch 2- to 12-cylinder magnetos, $25. Seven ignition wrenches in case, 25¢ set. White silk Irvin parachute with pack, $75. Turnbuckles, shackles, clevis pins, nickel steel bolts, large quantities exceptionally low prices. See us for bargains. Crawford Airplane Supply Company, Venice, California.

FOR SALE: J6-9 motor, Lycoming motor; cracked-up Laird; artificial horizon. Monocoupe and Fairchild parts. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

RECONDITIONED J-5 blades: $50 pair; 650 x 10 semi-airwheels with brakes, tires and tubes, $65 pair; 22 x 10-4 hubs, $20 pair; Type 347 Pioneer tachometers, 354 airspeeds, 505 oil pressure gauges; stock of good used parts for English Mark III engines. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

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KINNER C-5: 210; less main case and carburetor, $60. F-141 starter, Continental A-70 or 210, excellent, $85. Oversized (.010) Warner cylinders, $30. A-70 Continental cylinders, $25; also pistons, cases, valves. A-70-2, completely overhauled, $375. Wright J6-5, completely overhauled, $375. Completely overhauled Warner 125 for $450. G. D. Kelsey, Municipal Airport, Philadelphia, Penna.

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PROPELLERS: OX-5 with A.T.C. No. 453, $23.50. Aeronca, $15; Szekely 45, $15. For quick service, order from ad. List complete line, 10c. Bennett Propeller Co., Morganton, North Carolina.

FOR SALE: Waco 10 right upper and right lower. Uncovered, licensed. Very reasonable. Also rudder. Address Pilot, 3826 Gladys Avenue, Chicago, Illinois.

PROPELLERS: Just etched and reconditioned like new; J6-9, $85; J6-5, $75; Challenger, $65. Nine J6-9D cylinders, worn, $90 set. Nine J-5 cylinders, good shape, $90 set. Used Wright parts, 90% off. Guaranteed J-5 motor, just majored, $400. Challenger motor, $200. Florida Skyways, Miami, Fla.

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NEW CONDITION 150 h.p. Hisso, $30. OXX-6, $35. OX-5, $25. Two Bendix wheels with brakes, 30 x 5, $15. J6-7 speed ring, $20. One J-6 hand inertia starter, $35. One Irvin exhibition parachute, good condition, $90. Little-Greiner Flying Service, Springfield, Ohio.

SPECIAL CLOSE OUT: Five excellent silk parachutes, $50 each. Wings: Travel Air, Eaglerock, American Eagle, Swallow. Motor mounts: Whirlwind, Travel Air, Klemm. Propellers: Wood, steel, all sizes. Starters, motors, parts; J-5, LeBlond, Hisso. AERO DIGEST, Box 2104.

VELIE CYLINDERS: $10 each; main case, $25; Scintilla mags, $10 each; other parts cheap. M. Emling, 1527 Bewick, Detroit, Michigan.

AIRWHEELS AND CASINGS: 22 x 10-4, non-brake type, less bushings, like new, $35 pair. J. C. Gaffin, Fond du Lac, Wisconsin.

TRAVEL AIR 6000-B wings, complete with ailerons, tanks and landing lights. Pyle and Pioneer landing lights with bulbs, $15 to $35 per pair. Hisso 180 h.p., $65; 300 h.p. motor, $25. Wing spars, all types; J6-7 Travel Air fuselage and wings. Pioneer Aircraft, Teterboro Airport, Hasbrouck Heights, New Jersey.

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TRY OUR WING EXCHANGE: You can trade your wrecked wings or rebuilt ones for as low as $30. N. L. Aircraft Co., Vermilion, Ohio.

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FOR SALE: Tractor and Pusher steel propellers for 125 Warner. Extra sport type Warner hub. Wanted: Used engines. D. Cooper, 2206 Franklin Road, Berkley, Michigan.

EDO FLOATS: Model 2260, less installation and rudders. About 100 hours water time. Condition perfect, priced for quick sale at $600. For Waco F, Travel Air Light Sport, etc. Midwest Airways, Inc., Box 147, Cudahy, Wisconsin.

● WANTED TO BUY OR TRADE

WANTED: Fairchild Aerial Camera, Elwood rectifying projector, copying equipment. Give complete details and prices first letter. For sale: 2 Bosch FU-5 magnetos for LeBlond; run 50 hours, perfect condition, $15 each; both $25. Valley Airways, Inc., Winchester, Virginia.

WANTED: J-5 motor, prop, exhaust and speed ring, motor mount and wheels complete for 4000 series Travel Air. For sale: OX-5 motor, cowlings complete, and radiator for 2000 Series Travel Air. P. O. Box 134, Marshall, Texas.

WANTED: 2- to 4-place Amphibion, licensed or eligible for license. Give full particulars first letter. Montgomery School of Aeronautics, Montgomery Airport, Montgomery, Alabama.

WANTED: Ship less engine licensable for J-5, preferably Travel Air or Waco, or will consider OX Waco or Travel Air convertible to J6-5. General Airmotive Corp., Municipal Airport, Cleveland, Ohio.

CASH: For your airplane in any condition. Want J-5, J-6 motors and propellers. Want Airwheels, any size. J. E. Poisson, 1219 Penn Avenue, Grand Rapids, Michigan.

WANTED: Have cash for 2- or 3-place planes, needing repair or recovering no objection; should be within 400 miles radius of Pittsburgh. Must be cheap. Box 263, Bridgeville, Penna.

CASH PAID for used airplanes, engines, instruments, airwheels and parts in any condition. Give complete details and prices, etc., in first letter. Munch & Romeo, Inc., Roosevelt Field, Mineola, New York.

WANTED: Two used left wings, heavy type, for 2000 Travel Air; covered or uncovered; must be licensed. Price must be right. Grady Montgomery, Jackson, Tennessee.

WANTED: Two Fleet training planes. Give complete description and lowest cash price. Write AERO DIGEST, Box 2097.

WILL TRADE 320 acres good land near Sterling, Colorado, for licensed 4- or 6-place cabin plane. Write or wire for full information. Lloyd Hagemeier, 622 Beattie St., Sterling, Colorado.

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WANTED AT ONCE for cash: J6-7 250 h.p. late type Wright motor, with rear exhaust. Give full information in first letter. Michigan Aero Motors, Jackson, Michigan.

WANTED: Airplane, air-cooled, two- or three-place, open or closed. Wanted: Instruments, bank and turn, rate of climb. Foster A. Lane, Port Columbus, Columbus, Ohio.

HAVE CASH for new Challenger motor; immediate action if price is right. R. J. Lewis, 9605 Glenwood Road, Brooklyn, New York.

WANTED: Used 1932-1933 Aeronca Collegian, 40 h.p. Must be in good condition and licensed. Must be bargain for cash. Franklin Fechner, Knox, Ind.

WANTED: Kinner K-5 front exhaust 16-stud head engine. Give full particulars and lowest cash price in first letter. Vermilya-Huffman Flying Service, Lunken Airport, Cincinnati, Ohio.

WANTED: Aeromarine Klemm parts and fittings: fuselage, landing gear, instruments. For sale: Klemm wings, control surfaces, center section, fuselage, complete Ox-Weld welding outfit, three torches; will trade. R. Kodak, 1207 Longwood St., Baltimore, Maryland.

TRADE late de luxe custom Stutz Blackhawk sedan, many extras, perfection condition, for ship. Crack-up considered. No OX's. Pay cash extra if warranted. AERO DIGEST, Box 2103.

WANTED: Great Lakes airplane and Cirrus motor. Give full details as to condition of each and lowest selling price. James Long, Padua Hills, Claremont, California.

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WANTED TO BUY OR TRADE

AMPHIBION WANTED: Loening, 39 Sikorsky, Privateer, etc. Also Edo floats, Wasp Sr. and 125 Warner motor. Will trade licensed flying boat for J-5 land job. State full details and lowest cash price. AERO DIGEST, Box 2107.

WANTED: Kinner motor, preferably front exhaust, in any condition, complete or incomplete; also propeller for same. V. L. Belding, 64 Lincoln Road, Brooklyn, New York.

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START FLYING IMMEDIATELY by investing $30 in our club, which provides a weekly lesson of 30 minutes for $2 a week dues. $30 entitles you to ownership in 1935 plane. Lieut. John J. McCarthy, 1439 East 64th St., Brooklyn, N. Y. MIdwood 8-3251.

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WANTED: Someone to finance me through transport pilot's course. In payment after completing course I offer my services, or you make me an offer. Ira Hall, Arlington, Nebraska.

THE BENNETT PLAN places new airplane in operation for you. Ideal for flying clubs, also for pilots wishing to start in business. Little or no capital necessary. Write Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey.

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A SOUTH AMERICAN air line has an opening for a young man of good morals, high school education and under 27 who wishes to become a transport pilot and can deposit $1,200 to cover expenses during apprenticeship. AERO DIGEST, Box 2105.

AIRPORT OPERATORS: We are distributors and have in stock new Taylor Cubs available for demonstration and delivery to your customers. Sign up for agency now. Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey.

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PARACHUTES: Approved type. Seat, back, lap and chest; bought and sold, exchanged, repaired. Tell all first letter. Professional parachute jumpers and balloonist furnished for all occasions. Thompson Brothers Balloon and Parachute Co., Aurora, Ill. Established 1903. P.S.: Yes, we have Bat jumper.

2 EXCELLENT RUSSELL parachutes: 24-foot seat pack, pure white Japanese silk; fine condition, including carrying bags, quick sale $50 and $60. Shipped unpacked for your inspection. Glenn Fellows, Box 66, Jackson, Michigan.

IRVIN WHITE SILK seat pack, just modernized with new back pad, rip cord, etc., $90. Irvin Pongee silk seat pack, guaranteed like new, $70. R. Kenyon, Newtonville, Mass.

ONE EXCELLENT 24-foot seat type Irvin pongee parachute. Condition like new and open for inspection, $55. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Penna.

1934 IRVING 28-foot silk back pack parachute and 24-foot quick connector chest pack. Both for $300. Your own terms. Finance Co., Hemlock, N. Y.

TWO IRVIN PARACHUTES: 24-foot, seat pack, white Japanese silk, fine condition, complete with carrying bag, $70. Will ship unpacked, subject to your inspection. Michigan Aero Motors, Jackson, Michigan.

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TRANSPORT PILOT: Flying six years on all types, radio beam and blind flying. Airport management, plus seven years of newspaper experience. Furnish own equipment if necessary. AERO DIGEST, Box 2094.

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HELP WANTED: Instructor in airplanes and engines. Must have teaching experience and mechanic's license. Good salary and permanent position for right man. State experience and salary desired in application. All replies confidential. Write AERO DIGEST, Box 2099.

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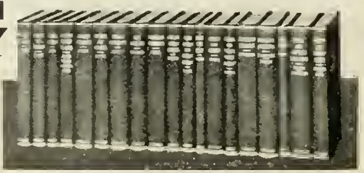

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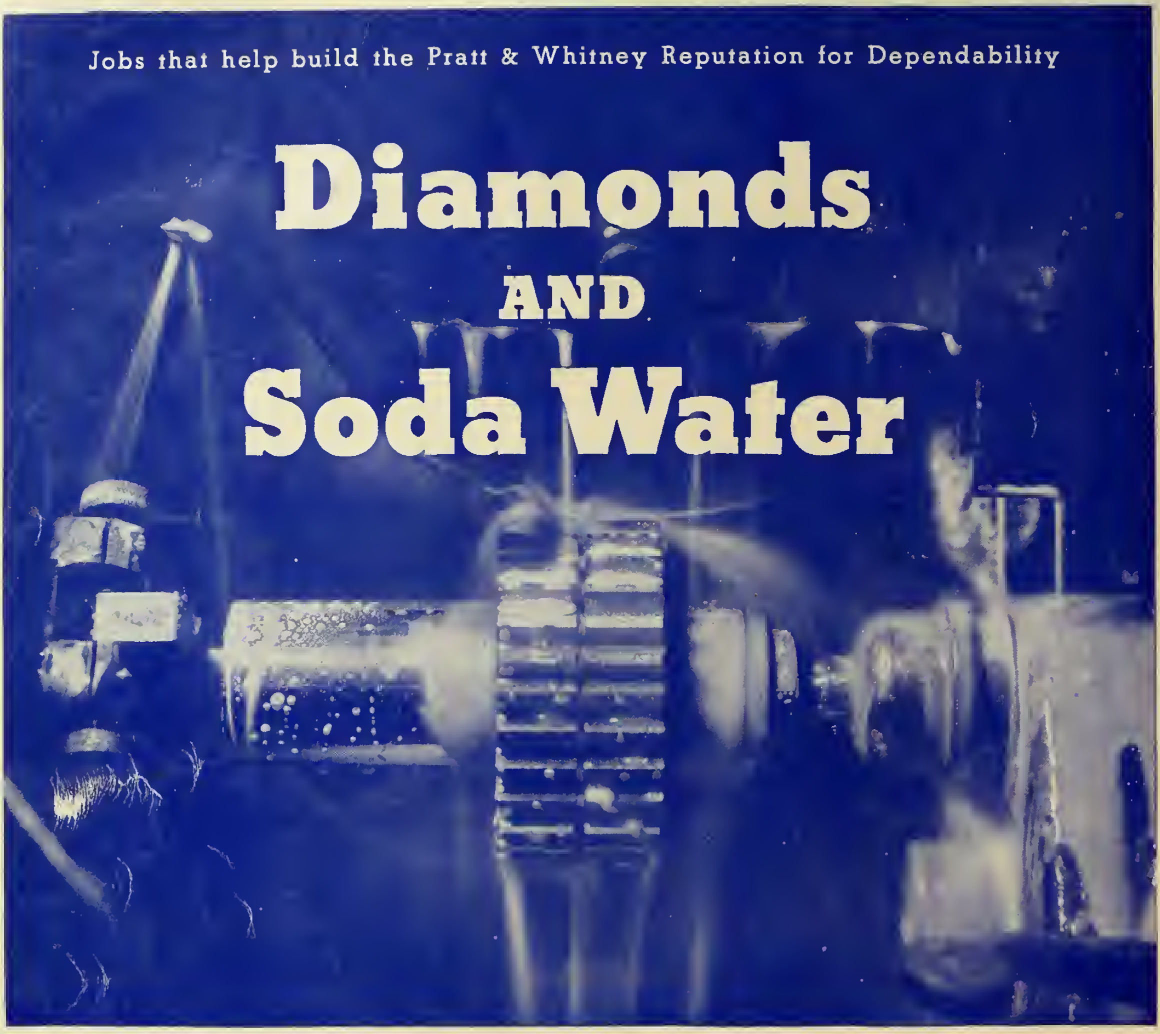

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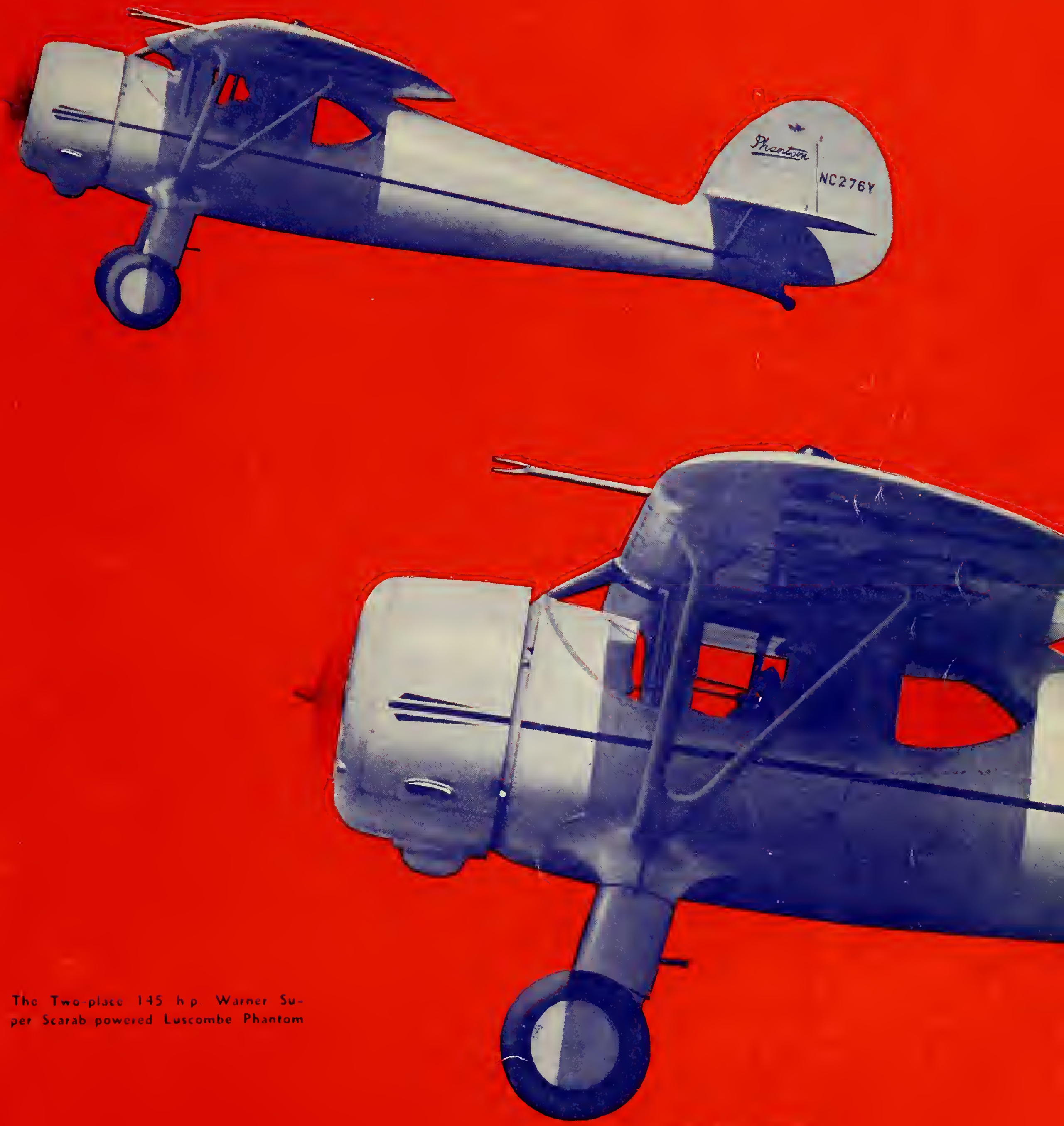

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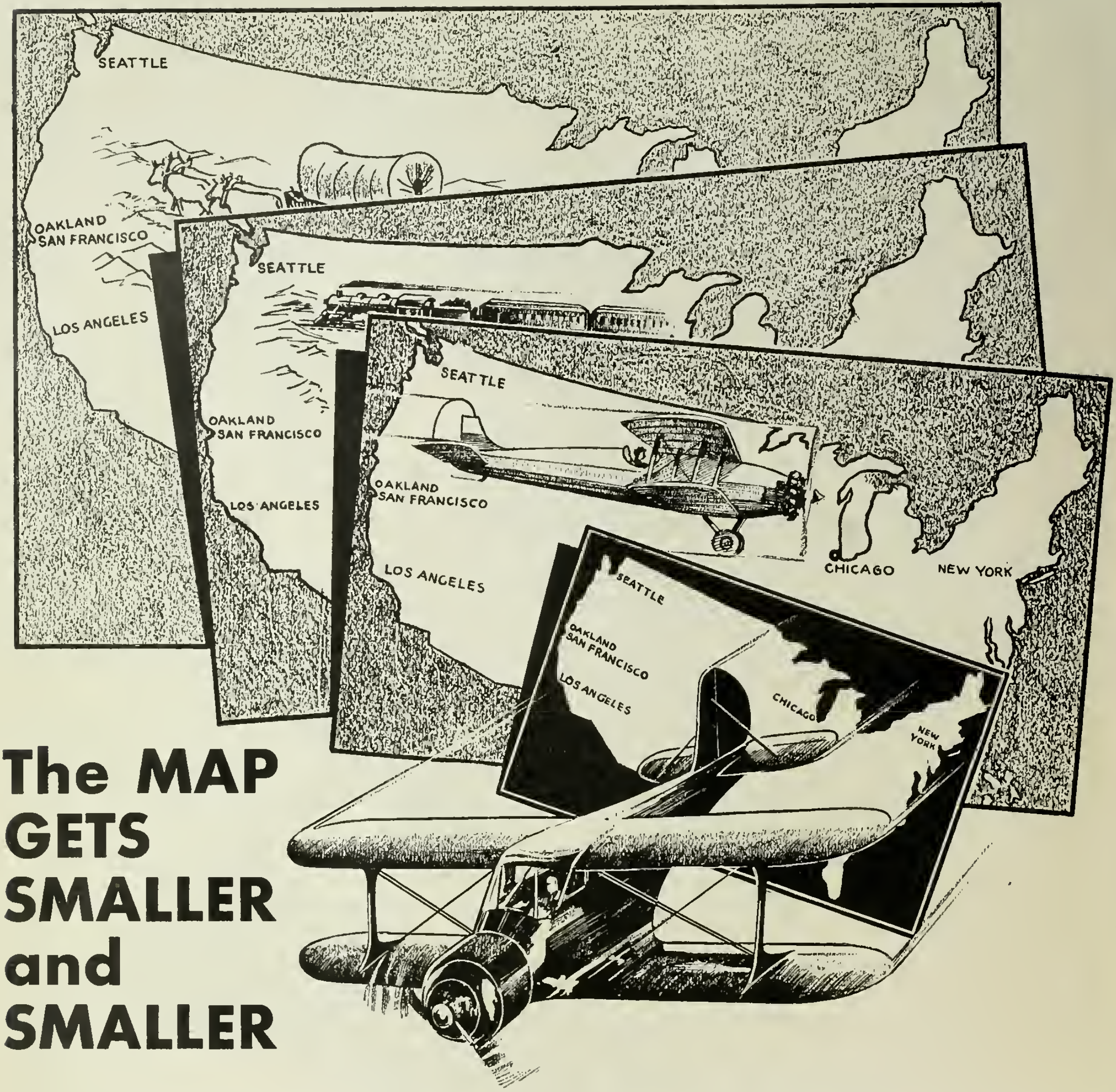

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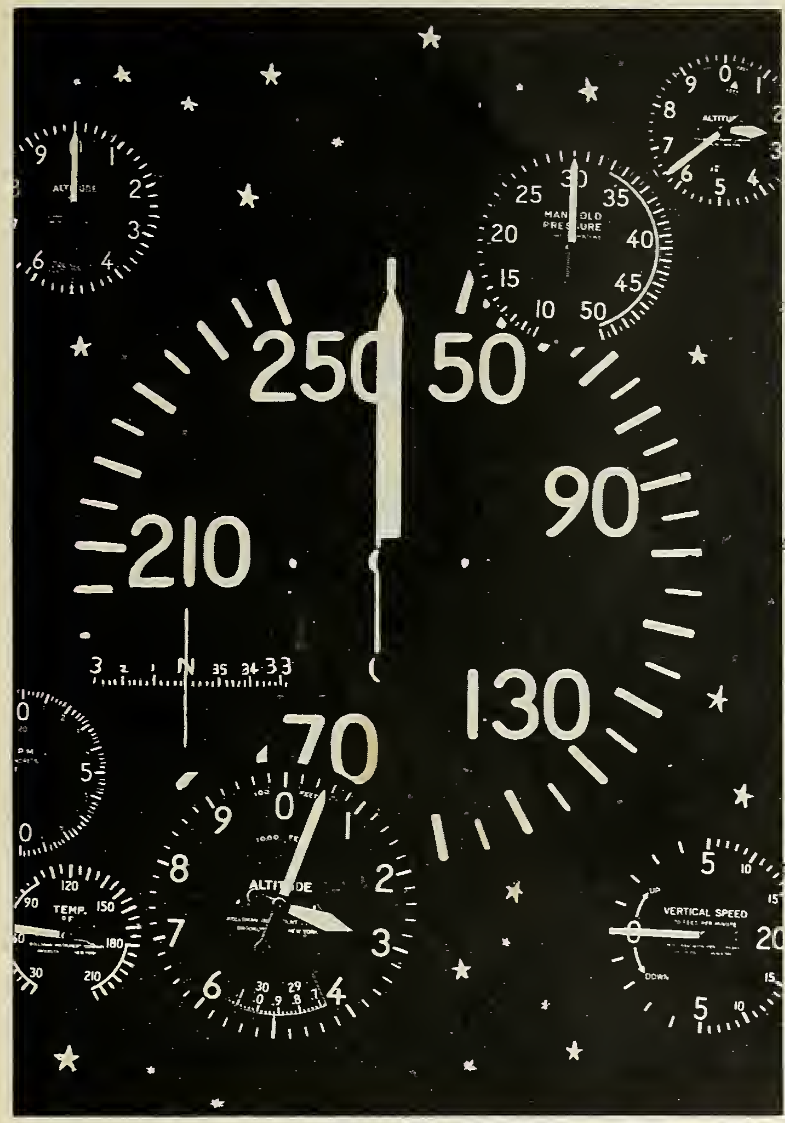

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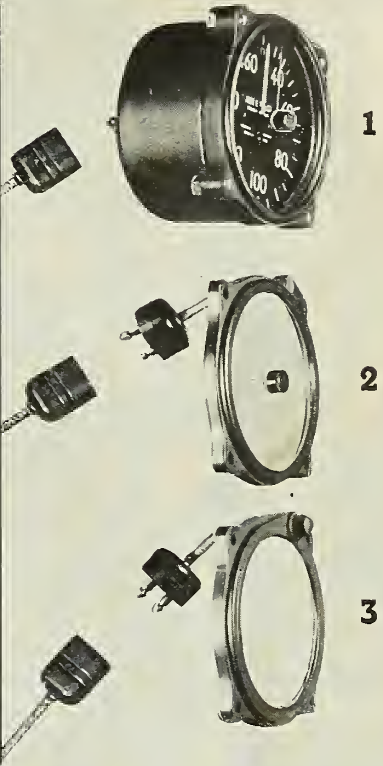

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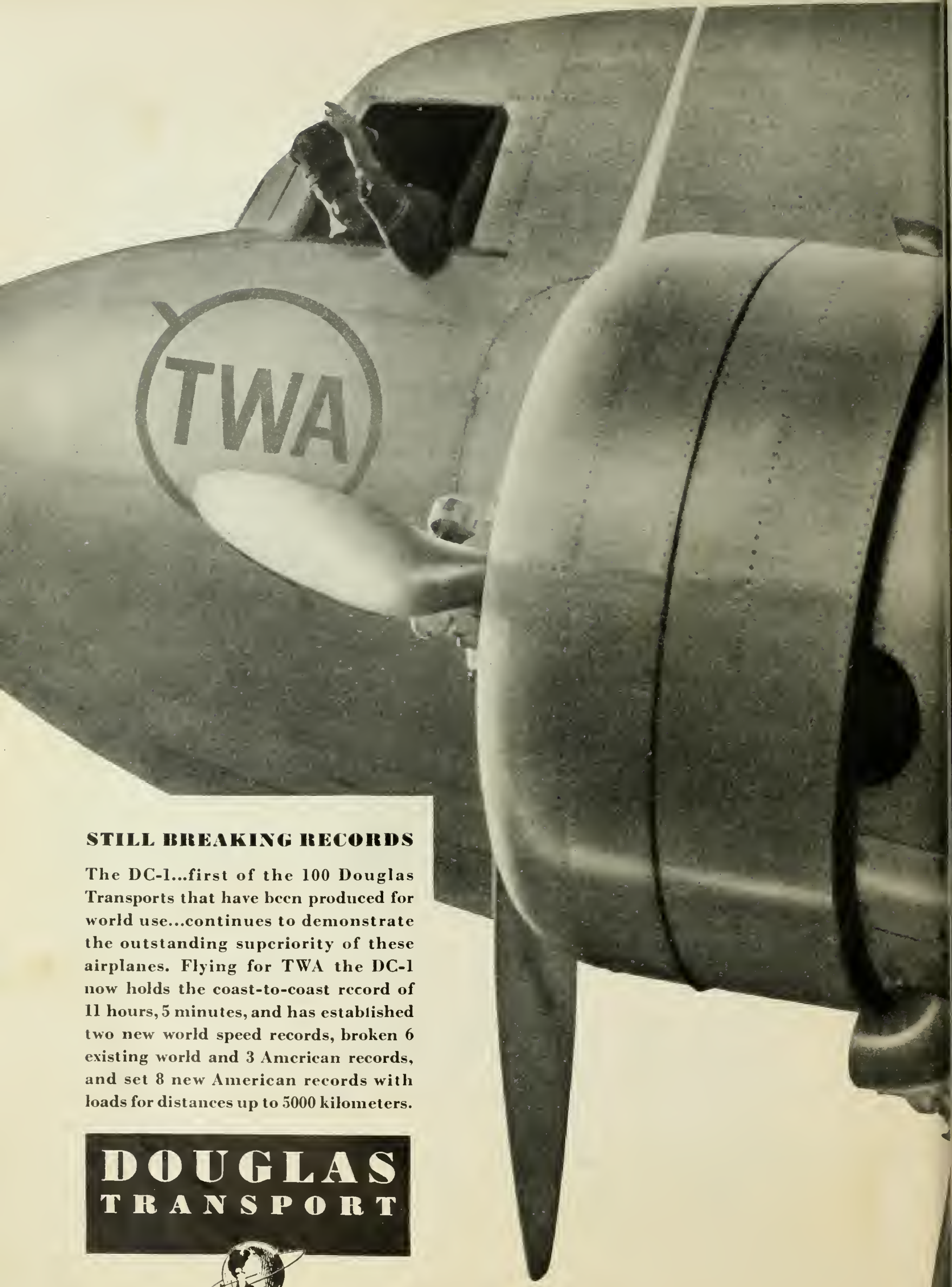

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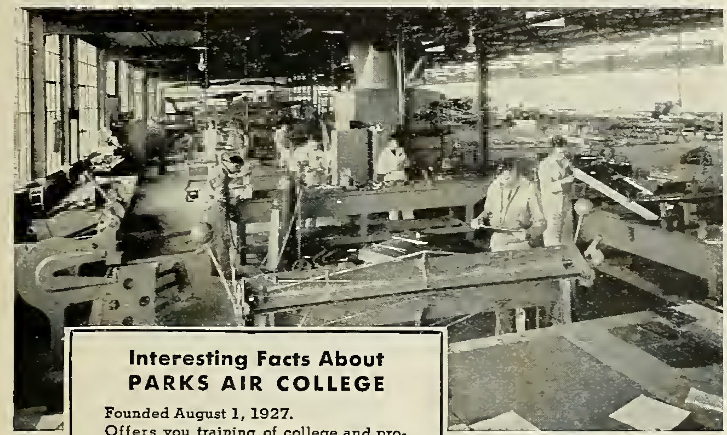

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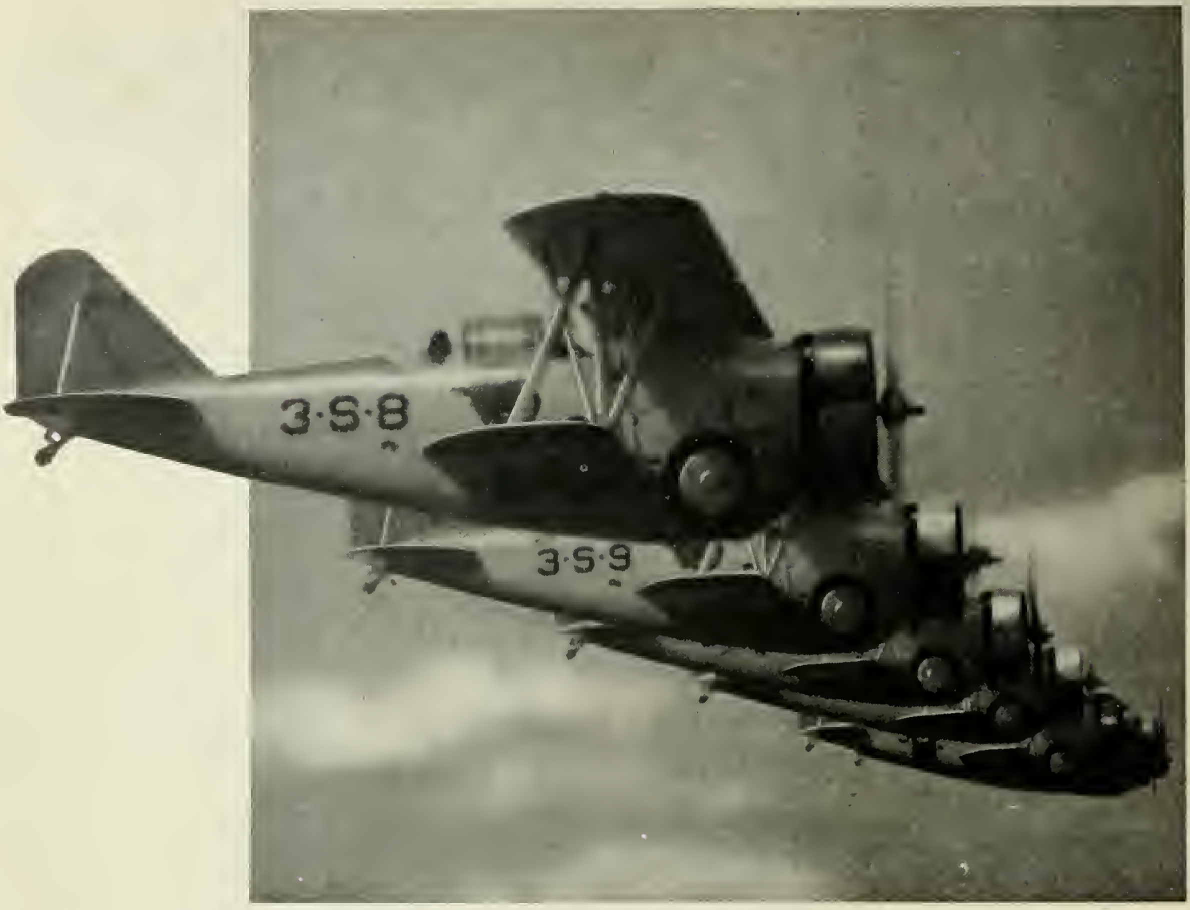

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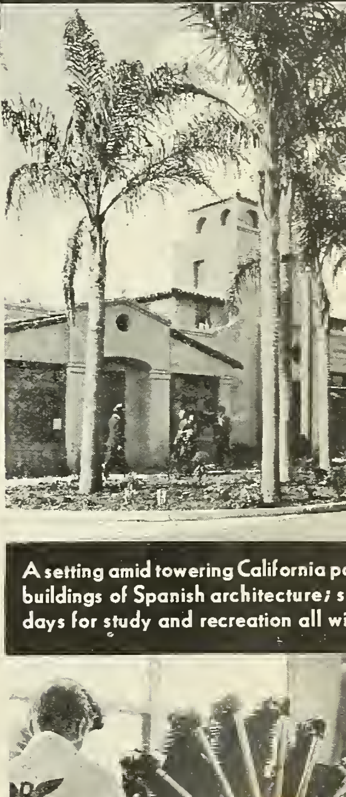

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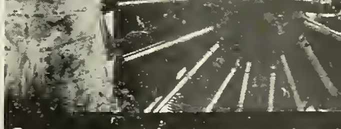

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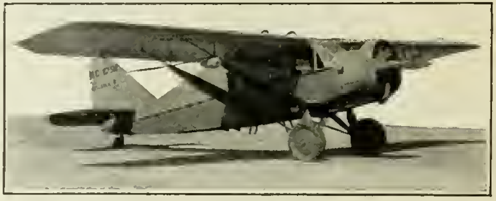

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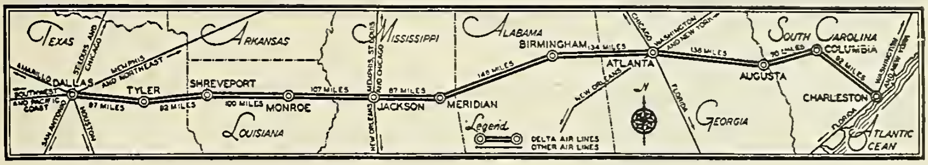

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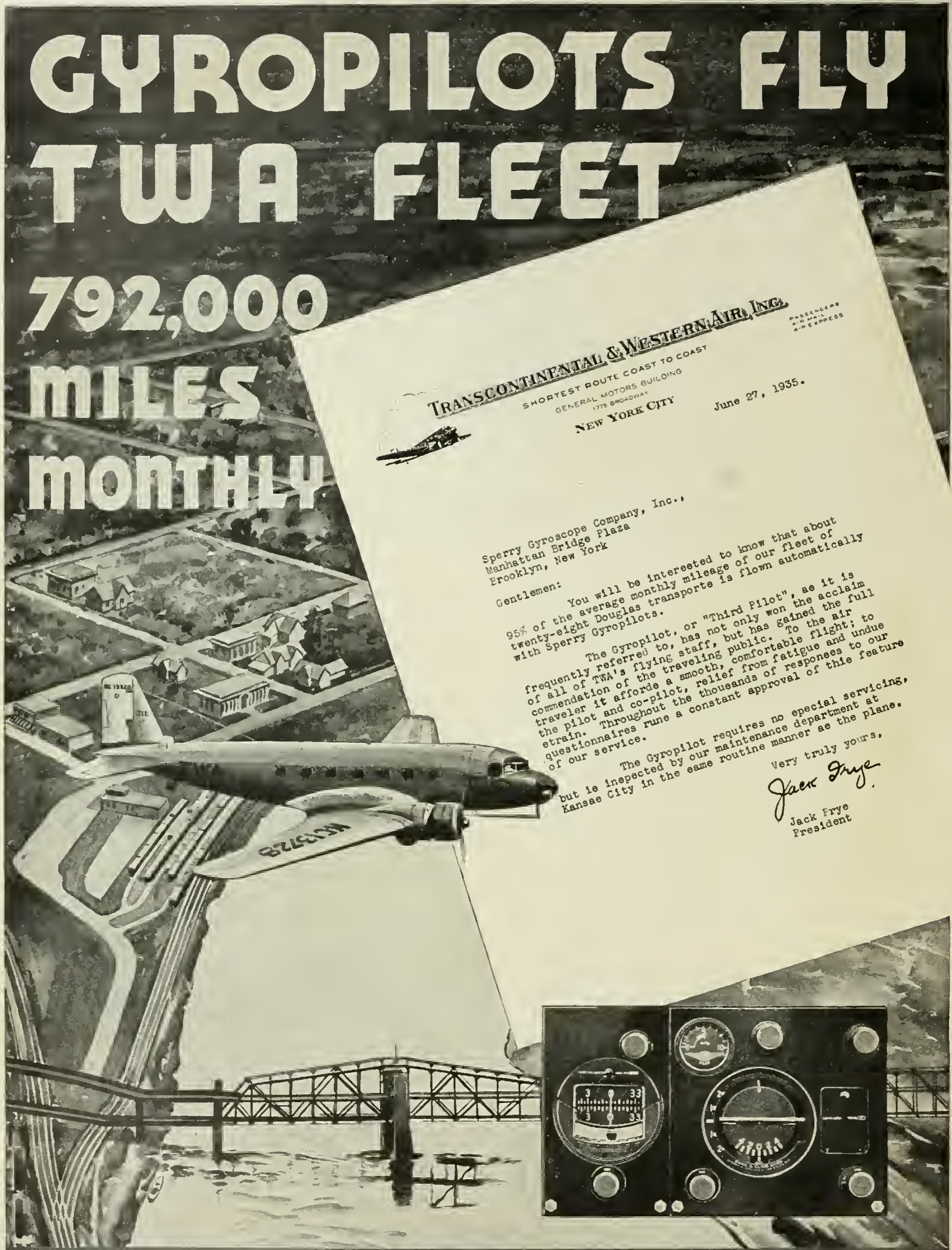

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AIR
HOT AND OTHERWISE

By FRANK A. TICHENOR

●

● Something is wrong somewhere. That much is sure. Otherwise, why the bickering and backbiting at Detroit over the Bureau of Air Commerce's airplane development program? Man may be a peculiar animal, but he's not so peculiar that he doesn't react instinctively to pain and pleasure. He doesn't let out a yowl of pain for no reason at all. Something somewhere is hurting him, even if he can't tell you exactly what it is.

At Detroit, representatives of the aircraft industry complained that the Air Commerce Bureau's policies were injuring them. They couldn't say precisely how or why. But they knew it, they felt in their bones, just the same. And, although Mr. Vidal ostensibly had an answer for everything and everybody in defense of his activities, no amount of his verbal aerobatics could shoot down the simple, incontrovertible fact that the industry is suffering a pain and doesn't like it any too well.

If Mr. Vidal were wise, he would quit gabbling to the industry, as he did in substance at Detroit, "Poo-poo, you just *think* you've got a pain. Why, this concoction I'm forcing down your gullet is absolutely harmless." If he were wise, he would have his potion analyzed to find out what there is in it that is giving manufacturers the cramps. Yes, if Mr. Vidal would take the trouble to do that, he would discover that the industry is not just a hypochondriac, as he implies. He might even be surprised to find that the industry agrees with him in his broad purposes and ultimate objectives. For all of us would like nothing so much as to see the day when planes are sold at low prices and in great quantities. No one denies that. But there is more than one way of skinning a cat, and Mr. Vidal ought to know by this time that there are a great many aviation people who have cause to think his is the wrong way.

If the Bureau's goal is commendable, what is it then about its methods which arouses distrust? Probably it is, more than anything else, that the entire program has a hollow ring. It doesn't strike a note of sincerity. The whole business started with a fanfare of publicity on the $700 airplane, and although the Department of Commerce is no longer so foolish as to mention price, the fanfare of publicity continues to blast the air. Such a blare of brass horns inevitably causes sober-minded men to wonder whether the band leader isn't more intent upon attracting attention to himself than upon playing music which would be sweet to the ears of American aviation. It causes them to feel that he would willingly resort to any device to attain his self-glorifying ends, even if it involved dissevering the established industry limb from limb, perhaps unto death.

This is what the industry fears. This is what it really means when it complains that Vidal's program is a sword of Damocles hanging over its head. It is the deep-seated apprehension that the Air Commerce Director may at any moment ride rough-shod over the industry if he regards it as expedient to do so.

The worst thing about it is that this fear is not just a case of depression-hangover jitters—it is only too well founded. Ever since his first outburst on the $700 airplane, Vidal's attitude has been one of disdain and disgust for everyone who did not see eye to eye with him. His whole demeanor has seemed to say, "You are a bunch of benighted ignoramuses. If you're left out in the cold when I usher in the millennium, it will be your own fault, and the devil take you."

And now, bearing out that attitude, he breaks forth with a new threat—a threat which confirms absolutely the industry's worst fears. If the manufacturers won't design ships which kowtow to his notions of what constitutes a safe airplane all right then he'll label them "UNSAFE" and hold them up for all the world to mock. That, essentially, is what his new proposal to license planes according to safety amounts to.

The New Deal has been prolific with abuses of the rights of individuals and private business, but no more vicious idea than this has yet come out of Washington. It opens the doors to tyranny as nothing else ever has. It would mean that the despots of the Department of Commerce could rule over the manufacturers with an iron hand. The satisfaction of a grudge or a whim could result in the death of a thriving business, while an economically weak favorite could be elevated to the heights of prosperity.

The dangers of this proposal are not in the idea itself, but in the utter impossibility of making it work. Safety is not something exact and measurable. No strong lines of demarcation can be found by which different types of aircraft can be classified as "very safe," or "moderately safe" or "unsafe for all save highly skilled pilots." It is one thing to speak glibly, as does Director Vidal, of pasting such labels on planes, but it is quite another thing to decide which label is to be pasted on what plane.

The only way it could possibly be done fairly and justly would be on the basis of the actual safety records of each particular type of ship over a period of several years. But that method is the last one the Bureau could, or would want to use. In first place there is the obvious fact that by the time it was possible to classify a ship according to its safety record the design would be obsolete and the classification largely meaningless. Even worse for Mr. Vidal and his fellow-schemers, however, is the fact that any such just method as that would defeat their own ends. It would mean that, above all others, their pet projects would have to wait a long time to be classified as the super-safe ships they want the public to believe them to be. For, remember—no matter how loudly the Bureau toots the trumpet of these ships, they are new, they have not yet *proved* their safety. And no amount of wishful thinking or theoretical argument can make them any more foolproof than they can actually demonstrate themselves to be.

Therefore, if classifications based upon actual safety records are not only improbable but repugnant to the Bureau's aims, there is only one other method remaining—arbitrary judgments based upon the personal prejudices of the high priests of the Department of Commerce. A handful of men with stubborn preconceived notions of how an airplane should be designed would have the power to condemn as "unsafe" any and every airplane which dared depart from their ideas. A few Washington bureaucrats could whip America's aircraft engineering brains into any trend of design they saw fit. They could enslave the entire civil aviation manufacturing industry and wreck its natural, healthy growth and progress.

The ridiculous aspect of this proposal is that it is so patently unnecessary. Anyone with a grain of sense knows that business inevitably gravitates to the company who offers the best product at the best price. And safety is and will always be one of the strongest selling points an aircraft manufacturer can make. So, if the Department of Commerce is so cocksure it has discovered the clue to super-safety in flying, why all this to-do about classifying aircraft? If Mr. Vidal has any real confidence in his projects, he ought to have confidence that they will sell themselves on their own merits, and not because he has pasted a label on their fuselages. If he is afraid to let his ships compete freely and openly with those the industry offers, then he had better fold up his development section and silently steal away.

Legend of a Good-Will Ambassador to the City of Montreal

●

CY CALDWELL

George Haldeman, Cy Caldwell, Al Williams and Casey Jones before the start of the annual Good-Will Flight to Montreal

● Every summer George Orr and Jim Guthrie of Roosevelt Field round up a large herd of American aviation people and shoo them across the border into Canada to visit the good folks of the Montreal Light Aeroplane Club and generally disturb the peace and quiet of Montreal. It's one of the most entertaining ideas that aviation has produced, and tends to promote understanding between our two grand countries. By visiting around like that we find out what the other fellow is really like; and it usually turns out that he's just about the same as ourselves, no better and no worse, merely another human trying to slide through life with the least annoyance.

You know, they can build bridges between here and Canada, like they did over the Niagara River at Buffalo, and have the Prince of Wales open one end of it and the Governor of New York State open the other, and print a lot of flowery speeches in the papers, but that doesn't get our people acquainted half as well as having a bunch of Canadians and Americans sitting down on an airport with a lot of cold bottles of good old Canadian ale and sandwiches set out between them. For in these happy circumstances the Canadian and the American are going to gradually open up, as the afternoon slides by, and tell each other what they really think about this and that. And they usually end up by deciding that while the other fellow isn't as sound in his views as they are, still he's a lot sounder than they previously suspected he was. And as that goes for both sides.

Now just as an example I happened to herd in with the Hon. J. A. Wilson, Controller of Civil Aviation in Canada, whom I worked for 14 years ago, and Air Commodore J. S. Scott, who was in command of the Royal Canadian Air Force until he resigned recently. An Air Commodore, by the way, is the same rank as a General down here, only usually more airminded and with a better grasp of the potentialities of air power. Jimmy Scott, as they call him, didn't know me from Adam's off ox, so I started off by asking him just who the Royal Canadian Air Force intended to proceed against in the next war with those few old Siskins of theirs—the islands of St. Pierre and Miquelon, or the neighboring colony of Newfoundland? That got him interested right away, and he proceeded to tell me about the Air Force, of which I used to be a Reserve member back in 1921, though he didn't know that. Then Mr. Wilson joined us, and the fact got let out that I used to do forestry patrols for the Air Board of Canada over the Crow's Nest Pass Forest Reserve in British Columbia and over some scrub spruce trees in Northern Manitoba flying with Major Basil Hobbs' unit, so of course I couldn't kid the General any more. Wilson told him that I was just an old Nova Scotian who got starved out in Canada after the war and had gone down and joined the Americans, and that he shouldn't permit me to get an Air Commodore's goat, as goat-getting was an old hunting habit of mine. That man Wilson is onto me and I never make any progress in my favorite sport when he's around.

Well, we three had a great time, sitting there watching the other planes land, and some time this summer I'm going to return to Canada and visit both of these gentlemen, and go along to Ottawa and look this whole Canadian aviation situation over and write a little piece about it. We people down here should know a lot more than we do about Canada, because they're one of our best customers, as we're one of their best customers. And although I'm a former Canadian I've grown out of touch with the latest developments there, on account of being busy checking up on Eugene Vidal and some other peculiar folk down here. But I'm going to wander up to Canada on my own, without any distractions like a goodwill flight around me, and I'll write a piece about what the boys are doing. But just while it's on my mind, I want to mention to the American manufacturers that we haven't done anything like what we should have done to build for the Canadians a plane for their far Northern flying. We've been asleep at the switch, because we've been trying to sell them planes that are all right for our commercial work here but which lack many things that the Canadians really need for flying in the unsettled regions of the North. Right now Bob Noorduyn, who was Chief Engineer for Fokker Aircraft, and his associate, Don Martin, are building a plane that incorporates many ideas that the Canadian pilots know are necessary; and they're building it right in Montreal, at Cartierville Airport. We have nothing quite like it here, but if we'd been wide awake we'd have had something along those lines long ago. As airplanes are practically hand-made anyhow, it seems only common sense to build what the customer wants, instead of merely producing something that you hope he'll put up with, because it's the nearest he can get to what he wants.

I'm very much in earnest on this point, because next year or the year after, the Canadians probably are going to put in an airline from the Atlantic to the Pacific Coast; they have most of the airports and emergency landing fields completed now, so Mr. Wilson tells me. Naturally they're going to need transport planes, and it probably won't pay them to build the ships themselves. It is on the cards for them to buy English or American transports; and it seems to me that as they have an Air Force which is really only a training unit with obsolete equipment, that when they equip their airline they should procure ships which, in a war emergency, could be converted into bombers and used by their Air Force. Air power, as I have pointed out before, lies solely in bombardment aviation, not in pursuit, or attack, or observation or any of those other hang-overs from the war of 1914-'18, which already is an old-style war, though few suspect it. What any country, large or small, requires to maintain its independence as a nation is air power, and air power is bombardment, and nothing else. So when a country is subsidizing any civil or commercial airline development it is only common sense to devise equipment which can be used also for war purposes, with the minimum of structural changes. At the present time all that the Canadians have under the title of Royal Canadian Air Force is a superbly trained group of pilots who, in time of war, might retain their identity as a Canadian unit, but undoubtedly would have to fly equipment produced in England, and possibly to fight under conditions of no more national import to Canada than those under which Canadians served in the Royal Air Force during the last war. Those conditions naturally suit England, whose manufacturers in the next war as in the last war, will produce aircraft *at a profit to the English manufacturers, for Canadians to fight in, and defend the Empire.* Why should not Canadians look forward to having their own aircraft industry, for peace and war needs? All wars are commercial, no matter how politicians may camouflage that fact to delude the great mass of the unthinking, so if Canada becomes embroiled in the next inevitable war, which the English are preparing for at the present time by making friends with the egregious Hitler and his fanatics (because the English are afraid of the French and their Air Force) then Canada should be preparing to produce its own aviation war equipment. And it can prepare best by procuring American transport equipment at the start, redesigned for especial Canadian needs, and in time to have the same or more suitable equipment produced by Canadian workers in Canadian factories. That's looking ahead a few years, but there's no law against the Canadians looking ahead themselves if they want to.

Now about this Goodwill Flight, which I'd better get started on: More than 50 airplanes left Roosevelt Field from 11 to 12 o'clock on Saturday morning; we all spent a night in Montreal, which is one of the best places in the world to spend a night in, so William Begg of Roosevelt Field says, and we returned on Sunday, leaving between noon and 2 o'clock. That is long enough for any group to spend together, for after the first day they start to find out what is wrong with each other, and that leads to unpleasantness. So just before we started to get on each other's nerves we took off for home. It was a fine trip, and if local aviation groups all over the country would get together and visit their neighbors in Canada or Mexico, just for a day or so, it would promote better understanding all around, even if we all found out that we all were a lot worse than we'd even suspected.

We had Ed. E. Aldrin of the Standard Oil Co. and party in their Douglas Dolphin, and R. C. Oertel of the same company in a Beechcraft, and Wm. J. Griffin, Jr., of the Gulf Refining Co. in one of their Stinsons. Al Williams was going too, but he had some mechanical trouble and didn't start. Then we had Col. J. Carroll Cone, Assistant Director of Aeronautics of the Bureau of Air Commerce in his Beechcraft, and O. J. Whitney, Beechcraft distributor at North Beech, in another Beechcraft, which were well enough represented to please even Walter Beech himself. Then we had Fairchilds, old and new, Aristocrats, Fleets, Wacos, Lairds, Travel Airs, Stinsons, Curtiss Fledglings and Robins, Birds, Monocoupes, Cessnas, Standards, Great Lakes, a Stearman, a Buhl Pup, a Taylor Cub, a Security Airster and a Kitty Hawk. Well, there were over 50 planes, anyhow, quite an armada, with over 150 persons in all. I flew with George Haldeman in an old Fairchild 71, and on the way up we overtook an Aeronca and two automobiles, which delighted us because we were bucking a head wind and weren't making any startling progress.

That's a beautiful flight from Long Island to Montreal, along the Hudson River and Lake George and Lake Champlain. When we passed over the Canadian border we could notice the difference at once, as the Canadian farmers all had to work and weren't at the movies spending their AAA checks like our rural lads at home were doing, for the American countryside was practically deserted. With the land about the same in both countries it's confusing to learn from Professor Tugwell or Mr. Wallace that a Canadian farmer can pry a living out of the soil but that an American farmer can make a living only out of the other taxpayers. I suspect that it's because our American farmers have all gone to agricultural and political schools and have become too smart to work hard any more.

There were no forced landings on the trip, going or coming, except for two Chinese students in a Fledgling. They only missed Montreal by a hundred miles or so, and landed on a farm near Ottawa, where they ran through a fence like the Japanese troops going through Manchuria. How they ever managed to pass the great St. Lawrence River without seeing it and following it to Montreal is beyond me. But anyone who even tries to explain a Chinaman is crazy. These two birds landed after dark—and why they kept oozing along after the sun went down is likewise beyond explanation. It seems though, that just at dusk they decided to land and had thrown out their strip map to watch it float to the ground so they could find out the wind direction! Only a Chinaman would think of something like that. Of course, the map instantly disappeared in the gloom, which didn't matter as they hadn't been able to read it anyhow. So they went on and hit the fence and a Canadian Immigration man, who was somewhat saddened to observe a couple of Chinamen impinging on the sacred soil of Canada. However, he was an understanding fellow who was used to seeing a lot of queer stuff trickle in from the United States, so he sent them on their way to Montreal next morning. Oddly enough, they made Montreal without mishap, where it was decided that one of them should go back

(*Continued on page* 80)

Part of the group and their planes at Roosevelt Field before the flight to Montreal got under way

Program of the 1935 National Air Races

● The 1935 National Air Races—August 30 through September 2—are expected to be the best in the eight years Cliff Henderson and his brother, Phil, have been putting on the air classic. And a most cursory glance at the lineup would lead one to believe that a very eventful meet is what might be expected at the Cleveland Municipal Airport during the Labor Day week-end.

Starting at the beginning, there is $12,500 in prize money in the Bendix Trophy Race, an amount certain to draw the best in the flying game. Not only will our own old-timers and a few new American faces appear in the Bendix, but it seems certain there will be substantial foreign participation. Just who will come from the other side to fly in the Bendix is not known as this is written, but there seems to be little doubt that some of the fuselages will bear overseas colors.

The Louis William Greve Trophy and $10,000 in prize cash for three races in the 550 cubic inch class, is the next outstanding event. Two of the races will be worth $2,500 each and there is $5,000 for the third. Louis William Greve is president of National Air Races of Cleveland; the $10,000 posted this year is a sharp increase over 1934.

And this year there is $15,000 in the Thompson Trophy Race, with the course extended from ten laps over a ten-mile course to ten laps over a fifteen-mile course, or a jump from 100 to 150 miles. The increase in prize money and extension of the course have been a decided effort to make the 1935 Thompson a truly international event. Not only that, but a definite request has been made that the United States government purchase, at the owner's option, the ship that places first. Just as in the Bendix, it appears certain that there will be substantial foreign participation in the Thompson.

It has been definitely asserted that Ben O. Howard will be in the Bendix in his *Mister Mulligan*, but at this time it has not been actually decided whether or not he will fly the monoplane in the Thompson. Through the winter Mr. Howard and his wife piled up some enviable records with the ship which was built for the 1934 Bendix, but which was damaged enroute to the Pacific coast for the takeoff. The ship was flown by Gordon Israel and George Cassidy.

In the 375-inch class this year there is another worth-while amount of prize money—$7,700. The first two of the races carry $2,100 each and the third $3,500.

NATIONAL
AIR RACES
Aug. 30 to Sept. 2
CLEVELAND

But with all the high-power racing, out in the Ohio hinterland there is probably more interest in the return of women to the racing game. There will be only one race for the girls, and that limited to ATC ships with maximum speed of 150 miles an hour, but it is expected that this field will be big. Amelia Earhart Putnam is sponsoring this race and in addition to $1,250 in prize money there will be the Amelia Earhart Trophy.

Another highlight is to be the Ruth Chatterton Transcontinental Derby for sportsman-pilots. In this the ships will be handicapped at Los Angeles to arrive at Cleveland on the opening day of the races and there is $1,000 in cash for the winner. Miss Chatterton at first announced that the cross-country race would be for stage and screen stars only, but later she elected to open the field to any sportsman-pilot, man or woman, who cared to enter. Word from the Pacific Coast is that entries have been extensive. At the time this is written it is known that Wallace Beery and Paul Lukas will fly in this race, and Ken Maynard and Hoot Gibson are two more of the movie stars who will participate.

This year the Hendersons are going in for more spectacular amusement features than in the past, and thus far a number of acts have been signed. Harold Johnson and his stunting Ford trimotor will be on the program. Jimmie Lynch and his "Hell Drivers" are booked for a prominent spot in the night show.

Two other events are the two ATC races for men, with $1,600 in prize money, and the two free-for-alls in the 200-inch class, with a total of $1,200 in prize money.

There will be the usual service participation, with the Marine Corps already having reported its plans to send thirty planes from Quantico.

The tentative daily line up of events and prize money follows:

Friday, August 30

Bendix Trophy Race, transcontinental free-for-all speed dash; $2500 to be awarded to pilot who breaks transcontinental speed record	$12,500
550-cubic inch ATC; 25 miles, 5 laps over the 5-mile course	800
200-cubic inch, free-for-all, 10 miles; 2 laps over a 5-mile course; qualifying speed, 115 m.p.h.	600
550-cubic inch, free-for-all; L. W. Greve Trophy; 50 miles, 10 laps over a 5-mile course; qualifying speed 200 m.p.h.	2,500
Parachute Jumping Contest	200

Saturday, August 31

800-cubic inch, Women's ATC handicap; 45 miles, 3 laps over a 15-mile course	$1,250
375-cubic inch, free-for-all; 40 miles, 8 laps over a 5-mile course; qualifying speed 175 m.p.h.	2,100
550-cubic inch, free-for-all; W. L. Greve Trophy; 50 miles, 10 laps over a 5-mile course; qualifying speed 200 m.p.h.	2,500
Parachute Jumping Contest	200

Sunday, Sept. 1

800-cubic inches, ATC; 25 miles, 5 laps over a 5-mile course	$800
375-cubic inches, free-for-all; 40 miles, 8 laps over a 5-mile course; qualifying speed 175 m.p.h	2,100
550-cubic inches, free-for-all; W. L. Greve Trophy; 75 miles, 15 laps over a 5-mile course; qualifying speed 200 m.p.h.	5,000
Parachute Jumping Contest	200

Monday, Sept. 2

200-cubic inches, free-for-all; 10 miles, 2 laps over a 5-mile course; qualifying speed 115 m.p.h.	$600
375-cubic inches, free-for-all; 60 miles, 12 laps over a 5-mile course; qualifying speed 175 m.p.h.	3,500
Unlimited, free-for-all; Thompson Trophy; 150 miles, 10 laps over a 15-mile course; qualifying speed 225 m.p.h.	15,000
Parachute Jumping Contest	200

FLYING OPERATIONS OVER THE HAWAIIAN ISLANDS

Stanley C. Kennedy
Pres., Inter-Island Airways, Ltd.

● Increasing demand for air communication has necessitated the purchase of new flying equipment for the entire service offered by Inter-Island Airways, Ltd., Honolulu pioneers in Hawaiian air transportation, according to Stanley C. Kennedy, president of the airline company.

These ships are of the Sikorsky S-43 amphibion type, and at this writing the first has been completed and is undergoing Department of Commerce tests. A second ship is practically ready and a third is under option. Designed to supplement those now in use, they are rated as 25-passenger, but will be equipped for 16 in the Hawaiian service, with extra space going to mail, baggage, express and incidentals. With a wing spread of 86 feet and a height of 17 feet 8 inches, they represent a gross weight of 17,541 pounds each and carry a useful load of 7,720 pounds, permitting 700 pounds of mail and express and 750 pounds of baggage.

On the air lanes in the territory of the United States to which these ships are going, remarkably ideal conditions will be found. It is this, perhaps, coupled with the care and watchfulness with which the service has been operated in the past, that has established Inter-Island Airways' unique record of "no accidents or injuries to passengers since inauguration of service."

Flights are practically exclusively over water, except during the approach to and departure from airports. While high mountains are to be found in the Islands, no routes lead over them. The highest point traversed is on the Island of Lanai at 3,400 feet. A further factor in Hawaiian flying is the entire absence of fog. Though rainstorms may be encountered, the "zero-zero" that occurs on the mainland routes is a thing unknown in this area of the country.

The frequency of schedules of Inter-Island planes enables connection with practically any steamship arrival from the mainland of America, Australia, or the Orient. Six days a week, Sundays excepted, planes depart from Honolulu for all chief inhabited islands—Kauai, Molokai, Lanai, Maui and the "Big Island" of Hawaii.

The general practice of travelers employing this means of seeing Hawaii is to cover the island of Oahu, on which the city of Honolulu is located, by motor car. Then, departing for Maui the flight gives magnificent air views of Molokai and Lanai in passing. Tourists seldom stop on these islands unless business requires it.

Laying over a day on Maui permits visits to the summit of Haleakala crater and into Iao Valley, both famous in Island legend and history.

Proceeding to Hilo, air views encompass sugar areas of Kohala, the Hamakua Coast and the highest mountain in the Territory, Mauna Kea. A motor ride of 30 miles from Hilo takes the traveler to Kilauea Volcano, the largest active crater in the world. Return to Honolulu is the following day—total elapsed time, 2 days 9 hours.

The morning of the third day a departure for Kauai will enable visits to the Spouting Horn, Lawai Beach, Waimea Canyon and Barking Sands, with return to Honolulu a day later—covering all the chief islands of the group and the outstanding high lights of each in four and a half days.

On present steamer schedules from California, a 19-day trip from California to California, coupled with the use of air service in Hawaii, will allow more than four days in Honolulu itself either before or after completing tours of the other islands.

The above data is all on the basis of present air service in Hawaii. With the advent of the new S-43 ships, air schedules will be materially shortened. No expansion of service beyond present routes is anticipated or probable, however, as the present routes cover all islands. The purpose of the new planes is purely to speed trips on established routes and to increase comfort and luxury for travelers on Inter-Island ships.

Inter-Island Airways at present operates three ships carrying 9 passengers each. It maintains two hangars at John Rodgers Airport (one for overhaul and maintainence, the other for passengers and operations) and a total of eight airports of which the Rodgers Airport is the home field. The cities served and their relative distances from Rodgers Field are as follows:

Hawaii Run

Molokai (near Hoolehua)	57 miles
Lanai (near Lanai City)	21 miles
Maui (Maalaea Bay)	110 miles
Hawaii (Upolu Point)	172 miles
(Hilo City)	235 miles

Kauai Run

Lihue	110 miles
Port Allen	120 miles

On Tuesdays, Wednesdays and Fridays the Kauai flights operate to Lihue only; on the other days they fly to Lihue, thence circle part of Kauai to Port Allen, thereby lifting mileage to approximately 130.

The Lanai flight is figured only from Molokai; total distance from Honolulu approximating 78 miles.

In the Rodgers Airport hangars, customary work of any established American airline is carried out. It is Inter-Island Airways' practice, to give the usual 20, 40 and 100 hour check on all engines, supplemented by a complete overhaul of engines and replacement of parts every 350 hours. Strict checking of planes and engines follows every flight.

Each 2,000 hours the entire plane is disassembled, checked, refabricated and reassembled with replacements where and if needed.

Inauguration of air mail service between the Hawaiian Islands last October

WINDS ALOFT
AND GROUND SPEED

HAROLD H. STRICKLAND

National Air Service, Incorporated

If every scheduled plane took full advantage of the upper air when practicable and "squeezed" another one to five miles per hour out of the winds aloft, thereby reducing operating costs twenty-five cents to one dollar per hour, in terms of 10,000 flying hours this saving would total $2,500 to $10,000—a sizeable item in any airline budget.

● Accurate determination of ground speed from wind aloft reports prior to takeoff necessitates solving one or more "triangles of velocity"; where one side represents wind, another air speed, and the third, ground speed.

Estimating the wind which would give best ground speed sometimes is an uncertain problem, for several triangles might have to be solved to find resultant ground speed, obviously an impractical procedure.

However, minutes saved by taking advantage of tailwinds or crosswinds and by avoiding the full force of headwinds, add up to an appreciable saving in a year's operation.

Wind aloft reports are furnished by Weather Bureau stations at specified hours. A westbound Detroit-Chicago plane (cruising at 150 m.p.h.) might be furnished the following typical report:

	DETROIT		CHICAGO	
Alt. (feet)	*Dir.*	*Vel.*	*Dir.*	*Vel.*
Surface	SW	18	WNW	20
1,000	SW	20	WNW	22
2,000	WSW	20	WNW	22
3,000	WSW	25	NW	22
4,000	W	20	NW	25
5,000	W	21	NW	28
6,000	WNW	22	NW	30
8,000	WNW	25	NW	32
10,000	WNW	30	NW	40

In order to determine the wind conducive to best ground speed, seventeen triangles would have to be solved. Airline pilots, flying this scheduled route, could make a fair guess. But, it would be preferable to furnish them with the exact ground speed caused by these various winds.

By means of the ground speed tables shown, the true effect of every wind direction, of every wind velocity, upon planes of any cruising speed can be determined without solving triangles. By use of such tables a wind aloft report and *ground speed report* could be furnished in the following simplified form:

	DETROIT		
Alt. (feet)	*Dir.*	*Vel.*	*G. S.*
Surface	SW	18	134
1,000	SW	20	133
2,000	WSW	20	131
3,000	WSW	25	126
4,000	W	20	130
5,000	W	21	129
6,000	WNW	22	132
8,000	WNW	25	128
10,000	WNW	30	125

	CHICAGO		
Alt. (feet)	*Dir.*	*Vel.*	*G. S.*
Surface	WNW	20	133
1,000	WNW	22	132
2,000	WNW	22	132
3,000	NW	22	137
4,000	NW	25	134
5,000	NW	28	132
6,000	NW	30	131
8,000	NW	32	130
10,000	NW	40	124

Thus, a wind aloft report would be delivered to a pilot in the form of a definite answer to a problem effecting scheduels and operating costs.

Using the tables is a brief and simple operation: Assume the plane's cruising speed to be 150 m.p.h. The wind aloft data (see graph) would be plotted on the 150 m.p.h. air speed curves; SW winds in the SW table, WSW winds in the WSW table, etc. Highest ground speed is apparent by referring to the vertical ground speed scale.

Now assume a more difficult problem: where a Chicago-bound plane has two cruising speeds, viz: 150 m.p.h. under 8,000 ft., and 180 m.p.h. over 8,000 ft. What wind will give best ground speed?

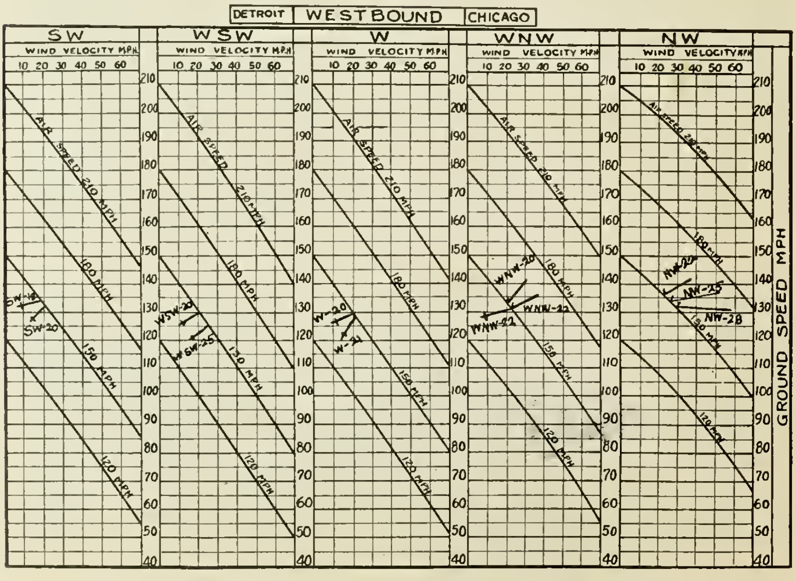
In this case best ground speed is obtained by plotting all the wind aloft reports under 8,000 ft. on the 150 m.p.h. air speed curve; and then plotting all the wind aloft reports over 8,000 ft. on the 180 m.p.h. air speed curve. Highest ground speed is again determined from the vertical ground speed scale.

When it is desired to plot the reports from two cities simultaneously, a cross $(+_1)$ could represent one city's wind at 1,000 ft., while a check (V_1) could represent the other city's wind at 1,000 ft., both plotted on the appropriate air speed curve.

Other factors might preclude flight at the altitude conducive to best ground speed; clouds, supercharging, ice, rate of climb, passenger comfort, visibility, terrain, etc. Obviously, these enter into the final decision as to what altitude is best. The tables are designed to take full advantage of the wind when practicable.

A typical headwind group is illustrated, with its effect upon a westbound Detroit-Chicago plane. (Complete tables for each route would contain 32 wind directions: N, NNE, NE, ENE, E, ESE, etc., eastbound and westbound.)

Their preparation requires considerable work. Detroit-Chicago, for example, eastbound and westbound, would necessitate solving about 896 separate triangles of velocity. This might appear hopelessly lengthy and complicated; yet by using a CDC (course and distance computer) the individual triangles could be mechanically solved in rapid succession, and the results placed in graphical form. The effort would be justified by scheduled airlines which regularly fly identical routes.



Wind aloft data plotted on air speed curves according to direction of wind

EDITORIALS

"The United States Government could materially assist the progress of aviation and assure for itself world leadership in air transport by allotting about $1,000,000 of the $4,800,000,000 WPA funds for the development of a 2000 h.p. aircraft engine. A successful engine of this power, would assuredly mark the greatest forward step toward the goal of international air transportation to date and would be an invaluable contribution toward better understanding between nations."—JOHN LORD, Managing Director, Saunders-Rowe, Ltd., Cowes, England.

Aircraft Shows In the Future

• After a lull of three years, the industry was appraised of the fact that there was to be a revival of the All-American Aircraft Shows in Detroit. Hardly given a chance to voice their sentiments, barely having enough time to prepare adequately for an event of this nature, the manufacturers found themselves in a dilemma. They were faced with the problem of either staying away, or exhibiting against their wishes at a time when the expense involved could very well be used for more productive purposes. And the result was not difficult to predict.

The show was a dismal flop.

When the aeronautical industry wants a real aircraft show, let it decide through the show committee of the Aeronautical Chamber of Commerce. It is not consistent with good business practice to force something down the throat of a customer, particularly when he neither wants, or needs, the dose.

Mr. and Mrs. John Public have yet to be given an opportunity of becoming as thoroughly acquainted with the latest advances in commercial aviation as they must be before they can be expected to become regular users of the airplane and the facilities it offers.

New Sites for The Air Races

• This year marks the expiration of Cleveland's five-year option on the National Air Races, and the local backers of the event are endeavoring to induce the NAA to extend that option for another period of similar length.

Cleveland has staged some outstanding shows since the races were first held there. Ordinarily, that city would be entitled to its place as the air race center, just as Indianapolis is for the automobile, and Louisville for the horse—but the airplane differs from the car and the horse.

There can be no similarity as the basis for renaming the city on the shores of Lake Erie as the air race city. The airplane is too mobile an element, distance means little and too many people are as yet unsold on the proposition that the airplane is *the* way to travel.

The air races could be advantageously held alternately in Los Angeles and some eastern city—Cleveland, perhaps, because of its substantial investment in grandstands and other structures at its field. In that manner, no one city would maintain a monopoly of this outstanding event which has done so much in laying the foundation for the increased speeds of our commercial and private aircraft.

Coordinating Air Express

• For years air express has been shackled by too many cooks who were spoiling the broth—in this case the steady increase in freight matter going by plane. The shipper rarely was given a fair deal when his package chanced to be consigned to a city which could be reached by air only if the services of the two existing air express systems were used. As a result rates were high, routing was complicated, and, often shipments were refused by the original carrier who elected to lose the business rather than trouble himself with a package which would have to be trans-shipped after it had reached the end of his line.

In the offing is a solution to this chaotic condition which was undermining the air express business. That is, if the domestic airlines get together and strive toward a common goal instead of working against each other as they seemed to believe was necessary in the past. A tentative agreement has been reached concerning plans which will unify air express activities. There remains only the signatures of the participating organizations before this long-needed change becomes effective.

The beneficial results of a unified air express system would more than compensate the lines for their willingness to compromise, and for their cooperative efforts along those lines. Rates would be lowered by the slashing of handling costs; routings would be expedited by the provision of a single way bill, and business would multiply because the customer would be receiving the service he requires and to which he is entitled.

Judging by what has happened in the past when air express agreements made it more expeditious for the shipper to avail himself of the speed of the modern airlines, the transport operators are due for a pleasant surprise when they audit their books after the unified air express system has been put into effect.

Forging Ahead On All Fronts

• Readers of our news pages will find much to become optimistic about when they scan the reports of activities in air transportation, aircraft and engine production, airport development and export of aeronautical products.

All along these lines phenomenal increases are recorded. Export sales for the first five months of the year reached $7,019,713, and the best months for this type of business have not yet been reported. The $17,000,000 record total for 1934 will in all likelihood be exceeded, keeping for this country's manufacturers of aircraft the palm for outselling all competitors in the foreign field—another attestation (if one is needed) of the merit of our aeronautical products.

Production continues its steady increase, reports indicating that commercial activities are taking a major part in leading the industry out of the depression. For the first four months of the year, 162 aircraft were produced together with 372 engines, comparing with 81 commercial aircraft during the similar period of 1934. Reflection of an impetus in airport construction and improvements being made is noted in the report as of July 1, with records that there were 2,343 airports in this country, compared with a slightly lesser number on the same date last year. With Federal aid forthcoming thousands of dollars are being spent by municipalities to improve their landing areas.

Air transportation is considerably ahead of last year. For the first five months of the year 285,798 passengers were carried, together with 4,906,995 pounds of mail and 1,623,882 pounds of express. Again the best travel months of the year have not yet been recorded, and it is conceivable that the approximately 500,000 passengers carried last year will be surpassed.

These optimistic reports might have been even more so if the government had confined its meddling to other industries, or to affairs which apply more directly to getting the country out of the depression. Aviation would have exceeded the fondest hopes of its most ardent admirers if it had been allowed to solve its own difficulties without the "advice" and interference of governmental bureaus that know little about it or its problems.

Personairlities

By Caldwell

● WRITING ABOUT early air circus days has reminded me that I owe you six readers a correction and some further information about the first of the stunt men, the very first to do a plane-to-plane change in mid-air, Lieut. Ormer L. Locklear, whom I mentioned in Elmer Dyer's biography in October, 1934. Lloyd O. Yost, of Southern Pines, N. C. and Middletown, N. Y. wrote me a letter and kindly loaned me a photograph of Lieuts. Short and Locklear. But in my casual way I mislaid both in my files—anything that goes into my files is usually lost forever! A determined search, with bloodhounds and flash-lights, in which the whole family joined, resulted in the letter's resurrection—and this letter is the only thing that I've ever looked for and actually found in my complicated filing system, which was designed by an efficiency expert.

"I would like to correct your friends on the West Coast and Dick Grace in his book," writes Lloyd, "in their information about Ormer L. Locklear of Fort Worth, Texas. The place was not Kelly Field, but Barron Field, Everman, Texas. The C.O. was Lt. Col. Turner of the Marine Corps, who was killed a few years ago in Guam. The two pilots who flew Locklear at Barron and also in his movie work were Lt. Milton Elliott of Gadsen, Alabama, and Lt. Shirley J. Short of Goldfield, Iowa—killed in Blue Streak Bellanca. Lt. Elliott's nickname was "Skeets" and Locklear's first name was Ormer, not Omar the tent maker.

"The reason I feel qualified to speak on this matter is that the four of us roomed together in Officers' Bachelor Quarters at Barron Field. And as Post Adjutant I wrote out their honorable discharge certificates when they left Barron to put on the plane-changing act under the management of W. L. Pickens. Their first show was at the old Uniontown Speedway, Hopville, Pa.

"Locklear was the first change plane artist all right. He was in charge of the cross-country stage at Barron, a primary training school. Lts. Elliott and Alexander were his pilots for the first experimental changes. Short was commissioned in the last bunch of cadets early in November, just before the Armistice. The movie men came to Barron and sneaked some pictures; and when they were released they caused a lot of trouble for the C.O., Col. Turner. But that didn't bother Locklear; he was East on leave near the end of the year 1918 and flew a Jenny down the Niagara Gorge!

"All of Locklear's experimental work was carried on at Barron Field, though he might have gone on a cross country trip to Kelly and put on a show for the boys. We all learned to fly together at Barron. I rummaged through my log the other night and found some entries—Oct. 30, 1918, a five point formation flight with cadet S. J. Short. (I was an instructor in Formation Stage, which was the last stage before the cadets were commissioned as 2nd. Lts.) Under date of Feb. 17, 1919, was a farewell train formation for Col. Turner when he moved to a West Coast Marine Base. We followed his train in formation (The Texas & Pacific) from Fort Worth and then broke formation; and Amberg and Locklear did some really dizzy train following on their own account. The pilots in this formation were Amberg, Elliott, Locklear, L. B. Jones, and myself. Locklear got out of the army a few days later and put on his first show soon after that.

"Under date of Oct. 17, 1919 is an entry in the log from Wewoka, Okla, where I was barnstorming, to Dallas, Texas, to the State Fair, to see Locklear, Elliott, and Short do their act before a great crowd. Called it Locklear Day. And if you know your Texas that was something for Dallas to stage a day in honor of a Fort Worth boy! They used two Jennies from Curtiss Co. at Love Field. Skeets Elliott attached the rope ladder they used to his ship, cutting a small slit in the fabric behind the back seat to pass a thin sash cord over the transverse member to pull the rope ladder back out of the way when taking off and landing. The whole performance didn't take them 30 minutes."

Shirley Short and Ormer Locklear

Shortly afterwards, as I have written before, Locklear starred in the first of the air pictures, *The Great Air Mail Robbery*—he was billed as The Great Locklear. His next picture was his last. Elmer Dyer was grinding a camera on the ground. It was a night scene; the script called for a spin from 5,000 feet, with the plane covered with phosphorous compound to simulate flames. A battery of searchlights played on the plane from below—and perhaps these searchlights blinded the pilot. Locklear and Elliott went up together. At 5,000 feet they went into a perfect spin, and they kept on spinning right into the ground. . . .

◆

● I AM honored to be able to present to you six undistinguished readers this handsome chromo of two distinguished gentlemen of Oklahoma, Charles W. Short, Jr., Manager of the Tulsa Municipal Airport, and Will Rogers, one of the few Democrats who still makes his own living and isn't dependent for support on us Republican taxpayers. It seems that back some years ago Will went and gave

(*Continued on following page*)

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WHEN YOU BUY A NEW SHIP SPECIFY THE GOODYEAR AIRWHEEL AND THE NEW GOODYEAR PNEUMATIC AIRWHEEL BRAKES

(Continued from preceding page)

Claremore, Oklahoma, an airport; so not to be outdone, Tulsa went and gave Charlie Short an airport. I was out there last month, and from what I could see I concluded that both Claremore and Charlie were real pleased with their airports. I know the last thing I told Charlie was to sit down and write me facts and dates about himself, and I'd run one of these little sketches here about him; and what he sent me was a biography, not of himself, but of the airport. I haven't got down to writing life histories of airports yet, though I may come to it in time.

I didn't stop at Claremore—in fact, the train only hesitated there a moment and seemed undecided whether to stop or just go on through—but I noticed a great big sign, "WILL ROGERS AIRPORT" outside of town, and in the town another great big sign, "WILL ROGERS HOTEL," on the biggest building; and then on the station, in very small letters, the word "Claremore." The funny part of it is, according to a Tulsa informant, that although Will Rogers is always talking about Claremore, he really came from Oologah, a little village near it, that the folks in Claremore crack jokes about, like the New Yorkers do about Hoboken. So not wanting to admit that he got his start in life by being raised in a village that was a joke to begin with, Will simply adopted Claremore because that seemed like a big city to an old country boy from Oologah.

I suppose Charlie knows Will—I never met him myself—but the fact that they're together in the picture is no proof that they ever saw each other before. Because out in Oklahoma when anyone wants to get his picture taken he sneaks up beside Will Rogers, and gets him in too, so folks will think he knows somebody who amounts to something. Anyhow, Will's picture really belongs in these columns because he's our champion air traveller and air publicist, and an Honorary Member of the Air Line Pilots' Association.

There's no use writing much about Charlie Short because I need the space to say a few words about the Tulsa Southwest Air Races, which were by long odds the most enjoyable I've attended in a long time—not that they were any different from any other races but simply because the hospitality of Oklahoma was so overpowering and the people out there were such fine folks that I'll always remember Tulsa with pleasure.

Well, first let's get this fellow Short off our minds: He's about forty years old, short of hair, short of wind, long on hospitality, and must have been a handsome young chap back in the gay nineties. A few years ago some evil characters tried to take that airport away from him, and the citizens of Tulsa and in fact the whole State of Oklahoma rushed in and said to leave the airport with him. He was born and raised in Cincinnati, Ohio, quit school at an early age, and joined his Dad in the lumber business. But when he kept getting splinters in his hands, he quit and went to Oklahoma in 1915 and spent considerable time in the oil business—everybody out there is either in the oil business or hanging onto the edges of it. He joined the Army in 1918 (it took him a year to make up his mind) and trained at Kelly Field and Mineola. He landed in France on Christmas Day, 1918, because he figured the Germans wouldn't have the heart to start fighting all over again. He seems to have used remarkable judgment about that war, for he spent the next two years attending aerial gunnery schools and generally playing around. They got tired of feeding him then and sent him back to the oil business, which he stuck with until 1927, when he retired from active life to manage the Tulsa Municipal Airport. Its an ideal job for an old aviator of quiet tastes, and I wish that someone would offer me a job just like it. Tulsa has one of the best airports and airport managers in the country.

Maybe Charlie does know Will

Now about these air races, the point that will be of greatest interest to race enthusiasts is the fact that unless Lee Miles does something about it he is going to be following Art Chester in the National at Cleveland this year. Art has put new wings on that Chester Special of his and in the two days of racing at Tulsa he beat Lee by a margin of 4½ m.p.h. in the first race and by nearly 17 m.p.h. in the second race. The race I saw was on June 30, when he made an average speed of 206.40 m.p.h. for the ten laps of the 5-mile course, and Lee made an average of 201.91. For several laps in that race Lee was leading him, and then Art passed Lee, whose engine was smoking and he evidently had to throttle down. I didn't see him after the race, as I had to get back to New York, so I don't know what he had to say about it. But Jim Ewing mailed me the results of the postponed race, which was held on July 4, and I'm sorry I couldn't wait to see it; but in that race Art Chester won with a speed of 206.82 m.p.h. and Lee was second in the Miles-Atwood with only 190.07. Jim didn't say, but of course there's a reason why Lee lost nearly 12 miles from his speed of a few days before. It's going to be mighty interesting to watch these fine race pilots at Cleveland this year. Roger Don Rae was the winner of the first race in the Keith Ryder, with a speed of 207.32 for the 10 laps. But as he had a 550 cu. in. Menasco and Art and Lee had only 375, we expected him to win anyhow. So the real interest was in the battle between Art Chester and Lee Miles. In the race of July 4 Roger wasn't entered, the race being for 375 cu. in. displacement engines only. The official times, certified by T. H. "Doc" Kinkade, Referee, and Earl Jones, Timer, are given elsewhere in this blurb.

For the stunts we had Milo Burcham in acrobatics in his Boeing Pursuit and Bird, Roy Hunt and Art Davis in their dog-fight, and a new one—Clem Sohn, of Lansing, Mich., in his Delayed Bat-Wing Parachute Jump which closed the show—and which I fear may close Clem one of these days. It's a thrilling sight to watch him speeding to the earth, his wings outstretched like those of a giant bat—in fact, you have to be slightly batty to perform this feat—and then the parachute opens, and doesn't get all tangled up with the wings. Or it didn't the day I saw him, anyhow. I don't guarantee him from week to week. On the way down, although we knew nothing about it until after he had landed, the acid with which he made smoke burned his foot; but he came right up to the announcer's microphone after the burn had been dressed, and he was smiling cheerfully. Of course, parachute jumpers feel no pain, as I've said many times before. Clem also won the jump to a mark in competition with five other enthusiasts. He ought to go over to Russia, where they really go in for parachute jumping. He'd probably become Dictator of Russia.

Being out west I was prepared for anything, from Indians to wild animals, so I was only slightly startled to discern what I thought was a large herd of buffalo thundering across the airport. When the great mass came nearer, however, it turned out to be the manager of operations, Mr. Frank McKay, than which there is no than whicher.

		Aver. Speed		Place	
Pilot	Plane	June 30	July 4	June 30	July 4
Roger Don Rae	Keith Reider	207.32	.....	1	..
Art Chester	Chester Special	206.40	206.82	2	1
Lee Miles	Miles-Atwood	201.91	190.07	3	2
S. J. Wittman	Wittman Racer	181.05	176.04	4	3
Joe Jacobson	Howard	147.96	154.98	6	4
Harold Neumann	Howard Racer	169.33	154.77	5	5

The new world's endurance record of 653 hours of sustained flight recently established by the Key brothers was made in a Curtiss Robin monoplane, powered by a Wright Whirlwind Engine. This remarkable flight exceeded by 100 hours the previous official world's record of 553 hours, established in 1930 by the Hunter brothers in an airplane also powered by a Whirlwind.

During the 27 days of continuous flight, it is estimated that the Key brothers flew a distance of 52,320 miles—equal to more than twice the circumference of the Earth at the Equator. WRIGHT is proud of this splendid achievement, because it represents the most gruelling test of endurance ever accomplished by an aircraft engine.

The Whirlwind's dependable performance and stamina are qualities which have influenced its selection as power equipment for many of the latest types of commercial and military aircraft. The new altitude series of Whirlwinds power the fleet of Lockheed Electra transports recently purchased by Eastern Air Lines; the Bellanca Senior Pacemaker cargo transport; the Beechcraft; the Curtiss-Wright Amphibian; the Seversky Amphibian; the Curtiss-Wright Speedwing, Trainer and Advanced Military Trainer; the Consolidated Trainer; the Waco cabin biplane and the Waco D Fighter.

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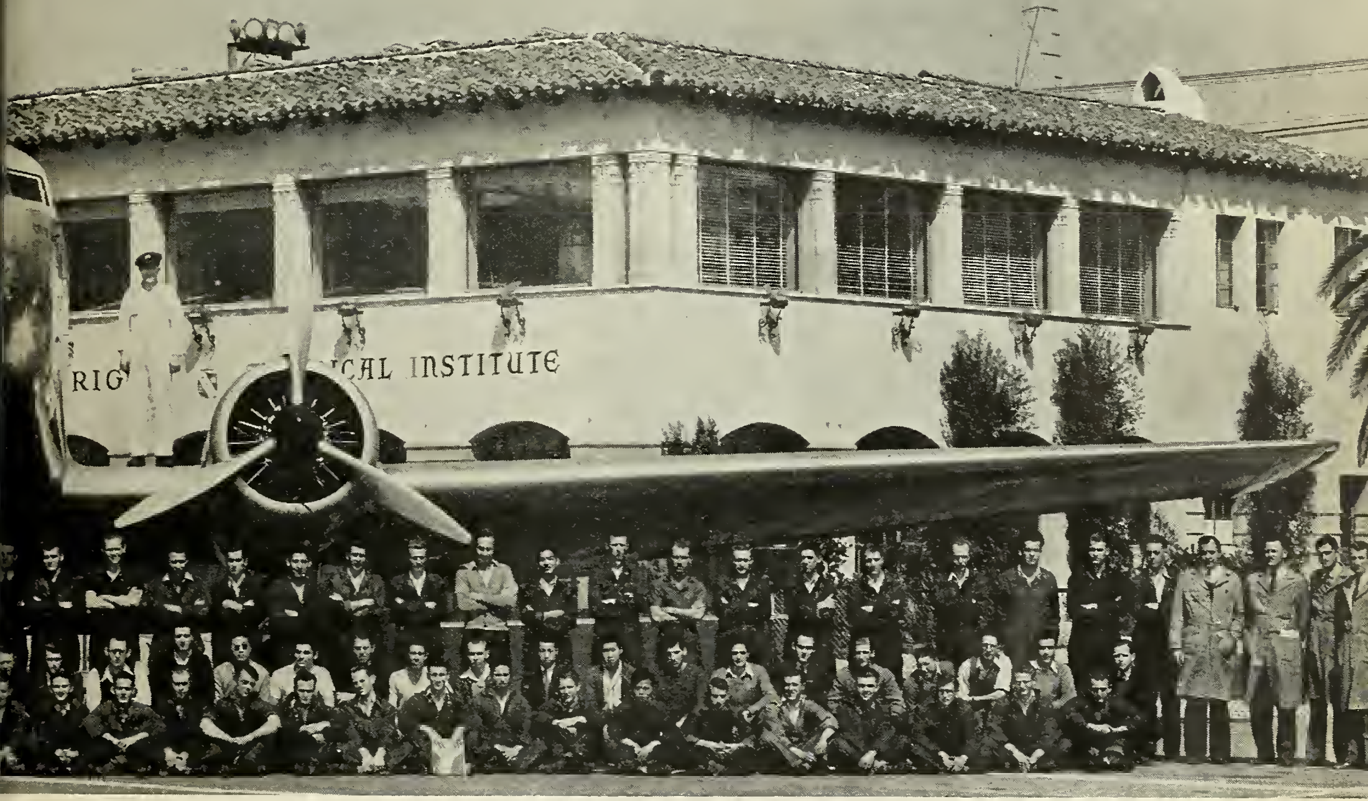

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DR. MICHAEL WATTER
DR. MAX M. MUNK

THE NEW BERNOULLI THEOREM

●

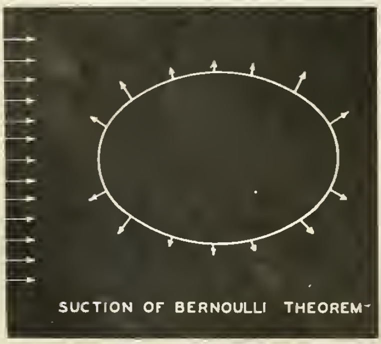
DR. MAX M. MUNK

● The old Bernoulli theorem of aerodynamics is used extensively in experimental and practical work for computing velocity from measured pressure. In theoretical and analytical work, it is used for computing pressure from the velocity previously computed. The theorem says that, measured from a suitable standard, there exists at each point of the airflow a suction equal to the square of the velocity multiplied by half the density. Written in equation form, and using conventional symbols:

$$P = -V^2 \rho/2$$

Application of this theorem is, however, restricted to steady potential flows of a perfect fluid. In the first place, it must be a steady or stationary flow—one which does not present a change of its flow pattern. The airflow set up by a moving aircraft, if it could be seen by its pilot, would be substantially steady, but the same airflow, if seen by an observer on the ground, would not be steady. From the ground, the pattern changes its position but not its configuration, and this change is sufficient enough to take the flow out of the rule of Bernoulli's theorem.

In the second place, the flow must be potential; that is, regular and harmonious as produced in a perfect fluid, originally at rest, by the medium of its pressure distribution only. With respect to that limitation (difficult to describe without using mathematical language) it is observed that ordinary aerodynamic flows are potential flows as far as the lack of perfectness of the air as the fluid permits, with some notable exceptions caused by wing and propeller effects. Thus, the propeller slipstream has greater velocity than the air around it, yet it fails to have greater suction, because the slipstream and the air motion around it are not constituent portions of the same unitary potential flow. In the third place, the fluid must be free of elasticity and of friction; otherwise special allowance must be made for the elastic effects and chiefly for the friction effects when applying Bernoulli's theorem.


SUCTION OF BERNOULLI THEOREM

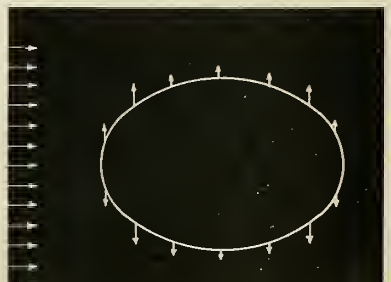
These explanations imply that Bernoulli's theorem is never entirely correct, and that there are a number of conditions to be fulfilled to make it even approximately correct. On the other hand, with respect to the requirement of the potential flow, it is well to remember that the theorem also holds for non-potential flows if the application is restricted to one individual uninterrupted streamline. Neither are the other limitations a serious handicap. As a matter of fact, the Bernoulli theorem, despite all the conditions imposed and imperfections noted, holds its own in aerodynamics. It is constantly used, and in many cases gives better results than the best test can give. The pitot tube is a practical incarnation of the theorem, although it is not the only practical application. For theoretical work, Bernoulli's theorem is indispensable for computing pressure distribution (over a wing, for example) from the velocity distribution computed previously, from which, by adding up the local effects, the resultant air forces themselves are then computed.

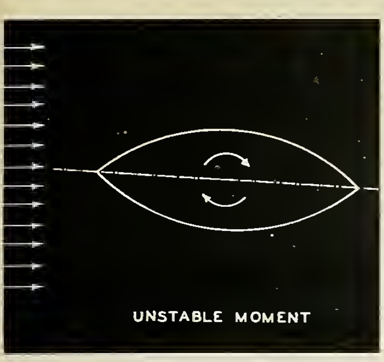
When using Bernoulli's theorem in that manner, an outstanding feature which proves inconvenient and imperfect is the fact that the velocity V appears squared. Simple as Bernoulli's theorem is, in that particular respect it still is not simple enough. An even simpler theorem, in which the flow velocity appears linearly, directly, or in the first power (not multiplied by itself) is greatly to be preferred. It is preferable because, as a rule, a flow in analytical work is described by describing a number of simpler and more primitive flows, from which, as constituents or components, it is made up by addition or superposition. This superposition extends to each velocity at each point.

$$V = V' + V'' + \text{etc.}$$

Now when applying Bernoulli's theorem, we cannot add the squares of these constituents, but we must square the entire sum, and hence there appear side by side with these squares, the mutual products of the velocities from different constituent flows. This complication is just enough to clog the mathematical investigation to the point of breaking down, where its clearness is impaired, its logical sequence obscured, and therefore its fruitfulness diminished. Extremely simple mathematics is suitable for bringing proper understanding to a larger group of people not mathematically inclined; and although Bernoulli's theorem is simple, it lacks the degree of simplicity necessary for such function.

The purpose of this article is to bring to the attention of the industry a modification of Bernoulli's theorem which possesses the desired simplicity. We call it the New Bernoulli Theorem in order to indicate its close resemblance to the other. This new theorem is not an approxima-


FICTITIOUS SUCTION OF NEW BERNOULLI THEOREM



UNSTABLE MOMENT

tion, not more than the old one is, at least, but within the scope in which it holds it is equally mathematically correct. It is as follows:

If U denotes the velocity of flight, and V the local velocity of air, a fictitious suction can be used for the computation of the resultant effect, which suction is equal to the product of the two velocities multiplied by the density.

$$P' = -UV\rho.$$

Since U is a constant throughout the entire flow, velocity V is the only variable, and now occurs directly or in the first power only. Although the mutual products of velocity components have disappeared, we have exactly what we anticipated.

"P" Represents Actual Pressure

Since P' does not agree with P, only one of these terms can represent the actual pressure, and the old Bernoulli *"P"* does this. P' is not the actual, but a fictitious, pressure useful for computing the resultant effect of all summed up pressure actions. It cannot be used for computing the local pressure; for that, we must take recourse to the old Bernoulli. However, when computing the resultant effect, the new term is generally more convenient than the old one. A further difference between P and P' adds to the simplicity of the procedure. The pressure P gives rise to a force effect proportional to the area on which the pressure acts, and directed at right angles thereto. The fictitious pressure P' gives rise to a force effect likewise proportional to the area of its surface, but not directed at right angles thereto. Rather, it acts at right angles to the velocity of flight U and at right angles to a direction on the surface itself normal to the direction of local velocity. This sounds more complicated, but actually, in all two-dimensional flows, and in most three-dimensional flows practically occurring, it is simpler. It then results in all added-up forces being parallel to each other, and being directed crosswise to flight. The two discussed features of the new Bernoulli rule make its application a great convenience, and a fruitful source of new finds, as we will illustrate in a special case.

In inquiring about the reaction of a perfect fluid, otherwise at rest, through which a solid is moving, and restricting ourselves (for simplicity sake) to the two-dimensional case, we see that there will be no resistance to the motion, because otherwise the energy derived or absorbed could not be accounted for. There is neither, in the strict potential flow, a lift or cross force. This follows from the quasi-symmetry of the fluid moving equally left and right around the obstacle, so that the side components balance each other. The symmetry required for making the flow a strictly potential flow is exactly the one balancing the side forces. There remains then as a reaction of the fluid motion a couple or moment only, and we inquire about its magnitude.

The Resultant Moment

We describe the fluid motion by the superposition of two component motions, each corresponding to a direction of motion at right angles to the other. Accordingly, if the velocity of motion is U, and the angle of attack α, the one component flow corresponds to the motion $U \cos\alpha$ and the other corresponds to the motion $U \sin\alpha$. Either flow gives rise to a velocity distribution around the obstacle proportional to the respective magnitude of these two motions. The fictitious pressures of the new Bernoulli are therefore proportional to these two expressions. They act normal to the velocity U, and they can be described by components parallel and at right angles to the direction $\alpha = 0$, which components contain as variables the expressions $\sin^2\alpha$, $\cos^2\alpha$, or $\sin\alpha \cos\alpha$. These pressure forces act on invariable lever arms, and hence the resultant moment can be expressed as a sum of products of constant factors, multiplied either by $\sin^2\alpha$, or by $\cos^2\alpha$, or finally by $\sin\alpha \cos\alpha$. That is to say, the resultant moment can be written:

$$M = A \sin^2\alpha + B \cos^2\alpha + C \sin\alpha \cos\alpha$$

where A, B and C do not depend on the magnitude of the angle of attack α.

This expression can be further simplified. It can be shown that A and B are not independent of each other. If the angle of attack changes slowly from 0° to 360°, the moment at each angle is not affected by the rate of change of the angle of attack, and therefore given by the same expression. During that turn, no mechanical work can be performed or absorbed, because it could not be accounted for. Hence the sum of these moments, for an entire revolution, must be zero. The term $\sin\alpha \cos\alpha$ balances by itself, because it is as often positive as negative. The two squares, however, are always positive, and each by itself gives the same sum, because there always exists a pair of angles where the sine of one is equal to the cosine of the other, and the range alike. It then follows that $A - B = 0$, or

$M = D\,(\cos^2\alpha - \sin^2\alpha) + 2E \sin\alpha \cos\alpha = D \cos 2\alpha + E \sin 2\alpha$.

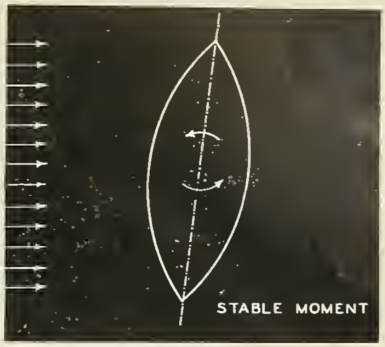
Writing at last

$F = \sqrt{D^2 + E^2}$, and $D/F = \sin 2\beta$

from which

$E/F = \cos 2\beta$, we obtain finally

$M = G \sin 2\,(\alpha + \beta)$, where G is independent of the angle of attack.

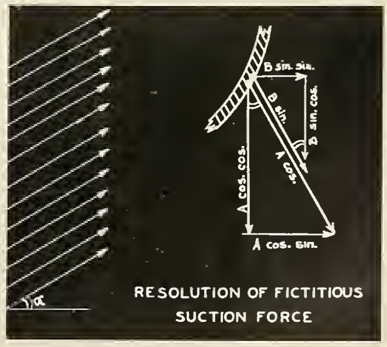


STABLE MOMENT

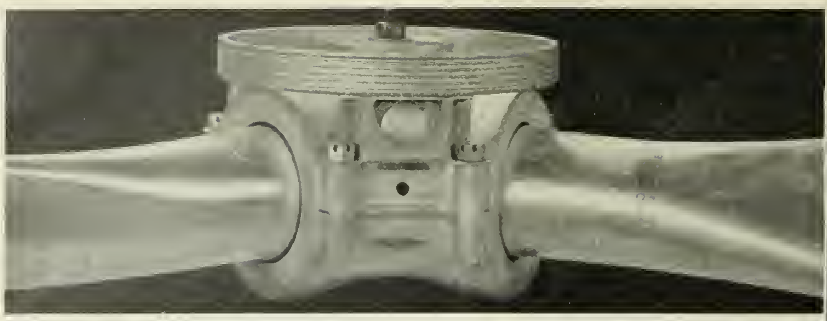
Application of the Theorem

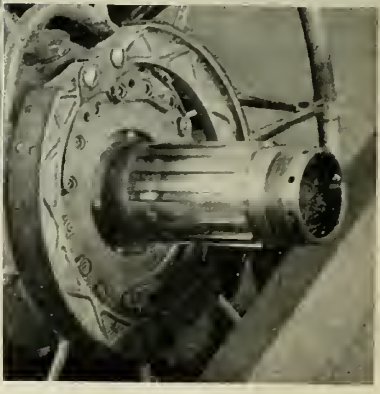
This expresses the classic fundamental theorem about the moment of a solid in a strict potential flow. That moment is proportional to the sine of twice the angle of attack measured from a suitable direction. There exist then at least two angles of attack (perhaps it may be considered as four), at right angles to each other, at which the resultant moment is zero. With respect to one of these directions, the moment is stable, tending to diminish a small change of angle of attack. With respect to the other, it is unstable, and a small angle of attack has the tendency to increase. The direction of best streamlining is generally the unstable direction, which is why a dirigible requires fins for making it fly parallel to its axis of smallest drag.

The new Bernoulli theorem is particularly suitable for demonstrating the laws of the resultant airforces of a wing section. This will be explained in an article entitled *Wing Section Theory* to appear in the September issue of AERO DIGEST.



RESOLUTION OF FICTITIOUS SUCTION FORCE





Propeller brake installation showing (left) drum with cooling fins, and (right) manner of installing brake bands on nose of engine

Propeller Brakes and Their Use In Multi-Engined Aircraft

● Aeronautical engineers have given considerable thought and concentrated attention during the past few years to the benefits that could be derived from the use of propeller brakes on multi-motored aircraft. Although a number of such brakes were designed, and some actually were tested, the great majority were either too heavy, consisted of too many operating parts, or were too intricate in design to withstand the rigors of regular airline service.

However, Raymond B. Quick, an engineering inspector for the Bureau of Air Commerce, carried out an intensive study of this problem and endeavored to overcome the deficiencies evidenced in the earlier models of propeller brakes. As a result of his work, he received a number of basic propeller brake patents, and recently, during the study of certain problems, proposed a very simple brake design to the engineers of Sikorsky Aircraft for inspection and consideration. Their combined efforts are evidenced in the development and construction of a hydraulic propeller brake, which was subsequently tested on the Sikorsky S-42 and recently placed in service on that ship by Pan American Airways, possibly the first time that propeller brakes have been used in a commercial operation in this country.

Results of Test Flights

The entire brake installation on the Sikorsky S-42, involving four propellers, weighs 55 lbs., and the simplicity of design assures longevity in service.

Test flights with the S-42 showed the three following benefits derived from the use of propeller brakes: Upon making a normal landing, the pilot closes the throttle. However, the propellers will continue to windmill, causing an air turbulence over that portion of the wing adjacent to the propeller, thus spoiling the lift at that point requiring greater speed to counteract for that loss in lift. If, however, the propeller is braked and stopped, the flow of air over that section of the wing will be smooth, resulting in higher lift and subsequent lower landing speeds.

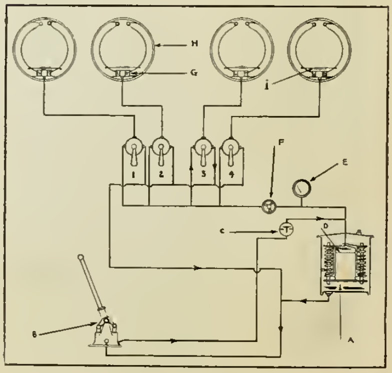
It was found that by stopping an outboard engine on the S-42 it was possible to correct for the loss of power by the use of the rudder instead of the usual practice of using both the rudder and ailerons. This, of course, is due to a smoother flow of air over that portion of the wing creating a greater lift than would be the case if the propeller continued to windmill. The resultant lift proved sufficient on the S-42 to correct for the loss of power. Disagreeable vibrations set up by the rotating propeller of a dead engine are also eliminated, and continuous three-engined or single engined flight can be maintained without annoyance from this source.

In case of engine failure caused by a broken part, the propeller may be immediately stopped, preventing destruction of the engine or further breakage of parts.

Operation of the Brake

The accompanying diagramatic sketch is taken from the brake system as installed on the Sikorsky S-42 for Pan American Airways. The operation of the brakes is as follows: Arista oil is pumped from a two-quart tank *A* by means of hand pump *B*. The oil then passes through a check valve *C* into an accumulator *D* oil pressure gauge *E* to a shut-off valve *F*. Pressure is increased by the pump and maintained in the accumulator *D* which works against springs. The accumulator has a capacity of 2000 lbs./sq.in. Pressure readings are indicated on the gauge *E*, 1000 to 2000 lbs. pressure being sufficient to operate the mechanism. When the shut-off valve *F* is opened, the oil passes through the main line to four control valves (1, 2, 3 and 4), which may be opened to operate the brakes singularly or collectively as desired. When a control valve is opened, the oil passes through the line into the cylinder *G*. The cylinder is bracketed to four bolts on the engine nose section and contains two fuel- and oil-proof pistons. The pistons are expanded by the oil pressure and force the brake bands, lined with Raybestos molded brake lining, against the brake drum *H*. Brake shoes are hinged by 6 bolts on the nose section 180° from the brake cylinder. A spring *I*, attached to the cast duralumin brake shoes at the cylinder, returns the pistons to a neutral position when the oil pressure is released, the oil then flowing back into the oil tank. The brake drum which is machined from a steel forging and is provided with cooling fins, is connected to 6 hub bolts on the (three-way) propeller by welded steel fittings.

Diagrammatic sketch of the S-42 propeller brake system showing the operation of the brakes



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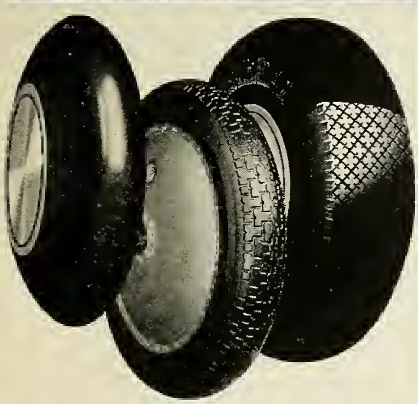

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Development of Aircraft Fuel Pumps

●

EDWARD S. EVANS, Jr.

Vice-President Evans Appliance Company

● Manufacturers of aircraft and aircraft engines did not take an active interest in fuel pumps until 1927. Up to that time many different types of fuel pumps were used to supply fuel to the carburetor, the majority consisting of a bellows type valve, weighing approximately 12 to 16 pounds and having small volumetric efficiency and short life. They gave a small volume of fuel, and were unreliable as the metal bellows cracked from crystallization due to oscillation. Although this type of pump was unsatisfactory, it had certain characteristics that were superior to gravity feed, among which was a more consistent pressure to the carburetor which was not possible when a varying head was constantly moving back and forth in the tank during the plane's flight. However, the bellows type was not dependable, and a gear pump known as the Army Type C-5 was substituted.

Early Types

This model, although more dependable than the bellows type, had many unfavorable characteristics, chief of which was the fact that it would not prime. This was due to the leakage between the teeth of the gears, which wore rapidly, necessitating frequent replacement or complete substitution.

The Army Type C-5 pump also had a constant leakage through the shaft bearing as the cork seal proved ineffective after a fair degree of service. Since a good fuel pump was absolutely essential to the satisfactory functioning of the engine, several companies developed a rotary type pump consisting of an eccentrically-located rotor and vanes which were in contact with the rotor bore at all times creating an excellent seal and giving pump prime characteristics which were heretofore unknown in the aircraft field. The application of this pump allowed development of the low-wing airplane and also gave more dependable service when switching from one tank to another by immediately eliminating the air in the reserve tank line and picking up the fuel at once without the use of the wabble pump.

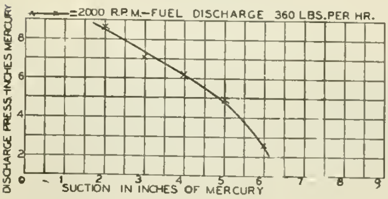


Fig. 1: Variable suction pressure causing variable discharge pressure with conventional type relief valve

The manufacturers of aircraft fuel pumps, however, saw the absolute necessity for a dependable unit which would effectively seal gasoline for thousands of hours without requiring service. The two seals which were subsequently developed had this efficiency.

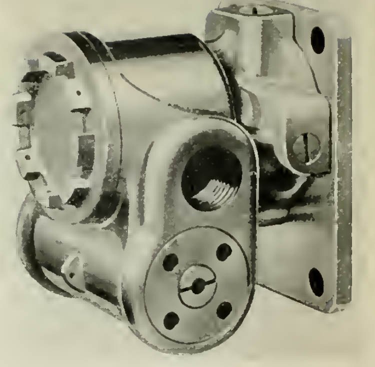
The first, developed by our company, was a spring-loaded dual sylphon seal having a hardened steel seat at each end of the sylphon which in turn rode on correctly tapered high lead bronze bushings of special analysis. The spring automatically compensated for wear which might take place and assured a perfect seal at all times.

The other seal was developed by the U. S. Army Air Corps at Wright Field and was generally an Oldham coupling pushed apart by a spring. The two seals in turn rode on two flat bushings which also effectively sealed the pump.

The above steps, undertaken with the requisite engineering by a commercial company, were of great aid in eliminating the hazards which were so common to aircraft fuel pumps before their introduction.

Following this our company made a complete survey of the United States to determine, in the majority of cases, the characteristic failures of fuel pumps. It was found that the chief failure of rotary fuel pumps as well as gear pumps was breakage of the small square drive on the pump. This was caused by a slight misalignment with the drive member on the engine which induced metal fatigue.

It is difficult to hold the drive member on the engine and the pump drive shaft within .002" or .003" and this slight misalignment was in time enough to cause failure. Accordingly, a flexible shaft was developed so that misalignment up to 1/64" could be experienced, without any material damage to the shaft or the pump. Since this type of shaft has been in use no failure through misalignment has been recorded.



New type Evans E-9 fuel pump

Through research and test work several other faults were corrected. The necessarily close tolerances in the pump were often taken up by the heating of the pumping unit, thus presenting a possibility of seizure and, in turn a failure. To eliminate this, a plate known as a "wear plate" was incorporated in the Evans pump, and was backed up by a spring so that any expansion in the rotor chamber from heat was automatically compensated for by the spring-loaded wear plate.

External Relief Valve Types

In 1932 all types of airplanes equipped with pumps used an external relief valve, consisting mainly of a ball check valve which by-passed the fuel back to the supply tank when the carburetor reached its maximum pressure. This necessitated extra tubing with the possibility of line breakage and the hazard of fire. Also, the wabble pump had to have an extra line so that it could pump to the carburetor around the mechanical pump. The elimination of this hazard was imperative. To do this, the Evans company

(*Continued on page* 47)

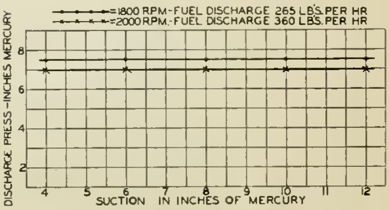


Fig. 2: Comparable values between variable suction pressure and constant delivery pressure of the E-9 pump

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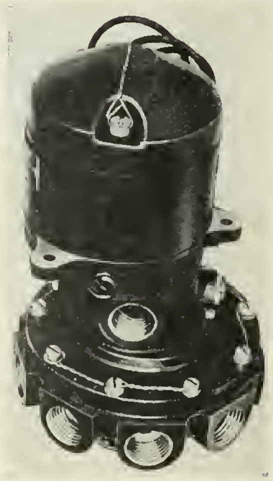
MECHANICAL DEICER EQUIPMENT

● The interruption of scheduled commercial air transport and mail service because of adverse weather conditions has initiated the development of various types of navigating instruments and other devices, for the purpose of overcoming certain of the difficulties encountered. One of the flight conditions to be surmounted was that of ice formation on aircraft during winter flying and to overcome this, the B. F. Goodrich Rubber Co. produced rubber fabric coverings which are affixed to the aircraft surfaces on which ice might form. These surface coverings, known as Goodrich Deicers, are composed of several layers of rubber and fabric, which form tubular air cells. The coverings are fitted to the surface of the aircraft, so that the cells are parallel to the surfaces which are to be protected. The number of longitudinal parallel cells in each width of surface covering depends upon the form and area of the surface to be protected.

Removal of ice formation is accomplished by periodically inflating and deflating the tubular cells, the constant movement of the surface coverings and the stretch of the rubber breaking the ice which is then carried away by the air stream.

Working in conjunction with the Goodrich company, the Eclipse Aviation Corp., designed and developed the mechanical units of the system which are required to supply the necessary air pressure and control the periodic inflation and deflation. An installation normally consists of an engine driven air pump, oil separator, and a distributing valve used in conjunction with the deicers, furnished by the Goodrich company.



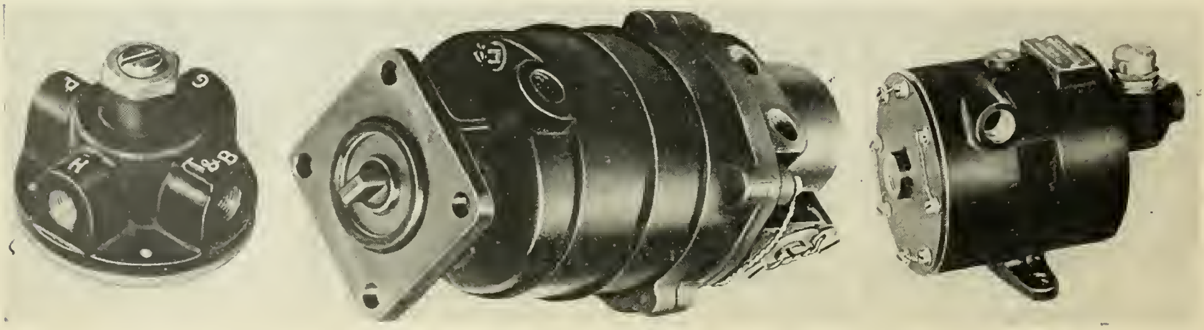
Distributing valve

The engine driven air pump provides the necessary air pressure to inflate the air cells of the deicers. The standard pump is of ample capacity to provide deicer operation on all single engined aircraft and in addition to deicer operation, the intake side of the same pump supplies suction to operate a complete set of the commonly used aircraft navigating instruments such as the turn and bank indicator, directional gyro and artificial horizon. Deicer installations on multi-engined planes generally necessitate the use of two pumps due to the increased volume of air required.

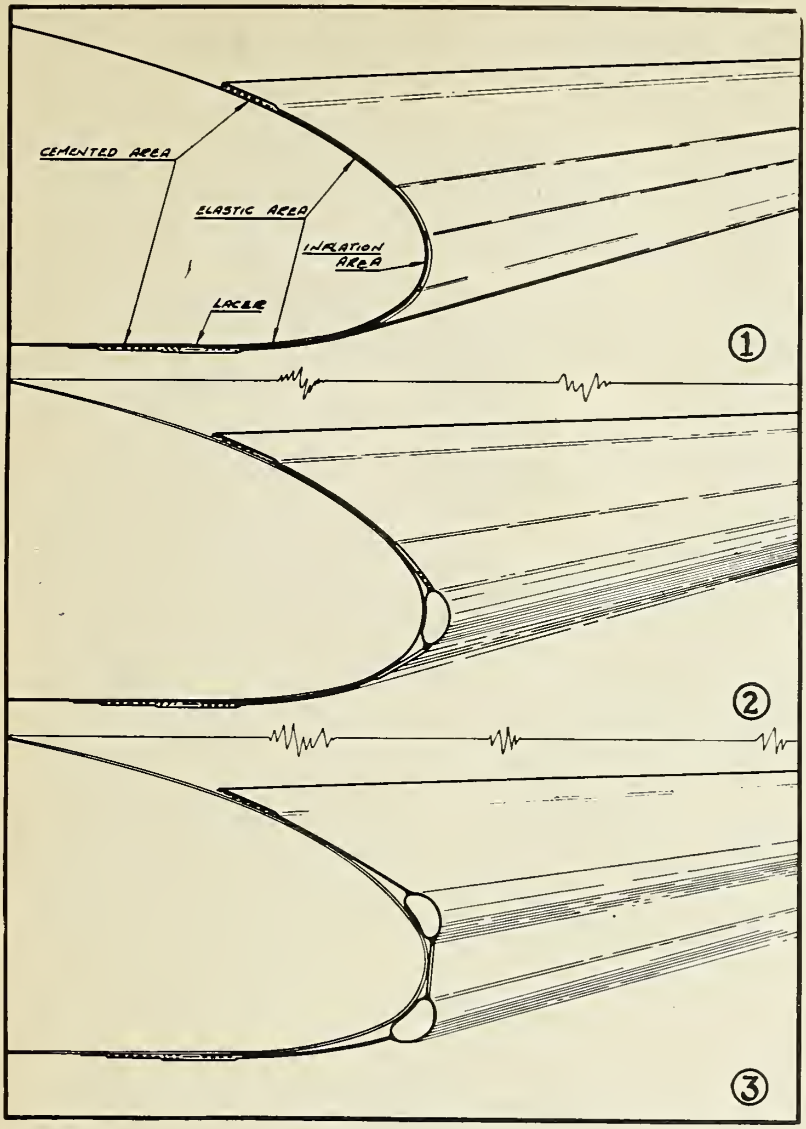
The Eclipse vacuum instrument pump is a rotary sliding vane type, mounted on and driven from the engine gun synchronizer drive or other specially provided drives. Several models of pumps with different driving members and mounting flanges are available for application to various models and makes of aircraft engines. The standard capacity pump designated as Type AP-8 is designed for operation at speeds not in excess of 2250 r.p.m. This limitation is normally maintained as the pump drives are generally operated at a ratio of 1:1 to engine crankshaft speed.

Positive lubrication is provided by an integral oil metering device (adjustable within close limits) which controls the amount of oil permitted to enter the body of the pump. This feature assures maximum pump efficiency and service life without danger of flooding the interior of the pump body with an excessive amount of oil. The metering device is furnished with oil at engine oil pressure. In operation, it meters to the interior of the pump a pre-determined amount of lubricant, ample to assure dependable operation and to provide for the sealing of the sliding blades where contacting the pump body. The amount of oil metered to the pump interior is held within the adjusted limits regardless of variations in engine oil pressure, viscosity and temperature.

The Eclipse oil separator, designed particularly for deicer use, is a two-purpose unit. It is installed in the air pressure line from the engine driven pump to the balance of the deicer mechanism and besides removing the oil vapor from the exhaust of the pump, it also regulates the air pressure to the deicer air cells. This is accomplished by an integral air pressure relief valve incorporated in the bottom of the oil separator and adjusted to a pre-determined air pressure value. When this is exceeded, the valve opens, expelling excess air pressure and oil



Eclipse suction regulating valve, air pump with tongue driving member, and oil separator with integral pressure relief valve



Typical three-cell deicer protected wing section showing: (1) deicers not functioning; (2) deicers functioning with center tube inflated and outer tubes deflated; (3) deicers functioning with outer tubes inflated and center tube deflated

which has accumulated in the bottom of the separator.

From the oil separator the air pressure is transmitted to a distributing valve which, as it rotates, controls the periodic inflation and deflation of the deicer air cells. Several types of valves are available for use in different installations. Some are electrically driven from 12-volt battery current, others are mechanically driven from a dual tachometer drive fitting. The valves are of the constant rotating type with the moving rotary gate driven through a multiple gear reduction, so that one complete cycle of inflating and deflating is accomplished in approximately 40 seconds. Certain of the electrical units are driven by series wound motors utilizing a variable rheostat control, and the time cycle of these units is therefore, adjustable within certain limits.

At cruising speeds, the engine driven air pump of standard capacity furnishes air at a pressure of approximately 9 lbs./sq. in., but the pressure normally required for deicer operation ranges from 5 to 7 lbs./sq. in., depending upon the installation. It is necessary, therefore to adjust the integral relief valve in the oil separator to the required air pressure value.

A constant air pressure of ample volume is thereby transmitted to the distributing valve which, electrically or mechanically driven, conducts the air to the deicer cells, periodically inflating and deflating alternate cells in accordance with the sketch shown herein of a typical three-cell deicer protected wing section.

A suitable distributing valve is furnished with each installation to provide for the grouping of air cells in the deicer installation involved.

A feature of the Eclipse distributing valve is the air dumping method utilized to conserve the air pressure supply to the deicer cells. To cause deflation, it is only necessary to exhaust into the atmosphere the air pressure in a cell or group of cells. This method, however, necessitates inflating the previously deflated cell or cells from a fully exhausted condition, thus requiring a greater capacity pump to maintain a complete operating cycle time limit. The distributing valves overcome this obstacle by dumping air from the deflating cell or cells into those which are to be inflated, thereby utilizing a good portion of what would otherwise be a waste of air pressure. This method makes possible the use of a minimum size air pump and the maintenance of the time limitation for the cycle of operation.

Recent Aeronautical Patents

●

The following patents of interest to readers of Aero Digest recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Access opening for use in aircraft construction. Charles E. Hathorn, Hempstead, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,002,944)

Quick release fastener for parachute harness. Stig O. C. Kuhlemann, Stockholm, Sweden, assignor to Irving Air Chute Co., Buffalo, N. Y. (2,003,205)

Aircraft. William L. Lewis, Los Angeles, Calif. (2,003,206)

Airplane. William K. Rose, New York, N. Y. (2,003,223)

Follow-up system for magnetic compasses. Mortimer F. Bates, Brooklyn, N. Y., assignor to Sperry Gyroscope Co. (2,003,270)

Aircraft having sustaining rotors. Heraclio Alfaro, Abington, Pa., assignor to Autogiro Co. (2,003,331)

Aircraft body. James B. Ford, Tulsa, Okla. (2,003,433)

Aircraft having sustaining rotors. Heraclio Alfaro, assignor to Autogiro Co. (2,003,620)

Retractable landing gear. Harold D. Hoekstra, Kenmore, N. Y. (2,003,885)

Automatic rudder control device. Eduard Fisthel, Berlin-Charlottenburg, Germany (2,003,930)

Amphibian airplane. Rufus R. Rand, Jr., Wayzata, Minn. (2,003,975)

(*Continued on page 47*)

Gas Turbines for Aircraft

JAMES P. EAMES, A.M.E.

● The gas turbine may be said to inherently possess certain advantages over the reciprocating type of internal combustion engine, chief among them being the attainment of high rotative speed, simplified lubrication systems, large power output per unit, and a potential gain in overall operating efficiency due to the more complete expansion of the combustion gases.

The primary difficulty which has retarded efforts to incorporate the gas turbine into a practical prime mover has been the inability of existing construction materials to retain their physical properties under the conditions of high temperatures encountered within its cycle of operation. The casing temperature to which the structural members are directly subjected represents, in addition to the initial temperature of the combustion gases as they are discharged from the turbine nozzles, friction and eddy losses, and the windage losses which, due to the transformation of the residual kinetic energy, are also present in the form of heat. Values of casing temperature as high as 1200° F. actually have been encountered in operation and as a 50% loss in tensile strength occurs in the majority of available steels at 1000° F., the problem is obvious.

Fundamental processes of constant volume and pressure combustion govern the operational characteristics of internal combustion turbines. In the explosion-type Holzwarth turbines, employing the first principle, the action is intermittent, combustion occurring within a closed chamber. Valves or some form of periodic distributing devices are consequently required to bring the combustion gases into contact with the turbine rotor. The second type necessitates the use of some means of compressing the combustion air, combustion occurring at constant pressure within open passages between the compressor and the turbine proper. Thus, the constant pressure turbine functions primarily upon the maintenance of a steady flow of fuel and air to the combustion chamber, and a steady discharge of combustion gases through the turbine nozzles.

Upon comparison of the above types, the explosion-type turbine becomes apparently more practical for aircraft adaptability, since it requires lower compression-pressure values for satisfactory operation, and offers greater facility for cooling. However, due to its intermittent action, it does not exert a constant torque as the other type does. Also, the tendency toward extremely rapid reduction of gas velocity during the expansion period increases the complications involved in maintaining a high average turbine efficiency.

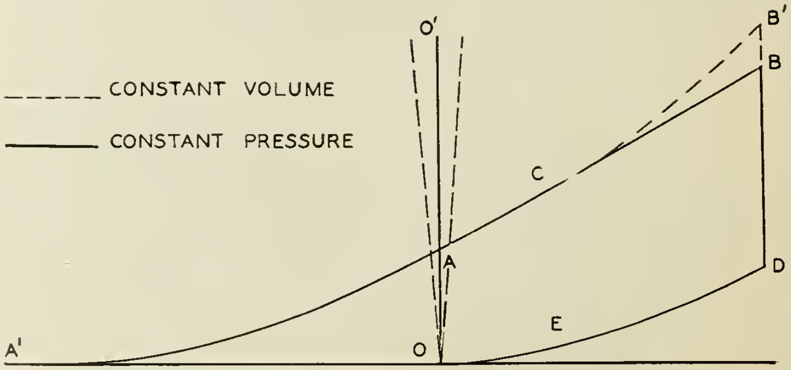
Utilization of a certain proportion of the heat energy available in the exhaust gases, or regeneration, represents a valuable aid to increased turbine performance, in that this waste thermal energy heats the fresh charge after compression, and also at constant pressure. This function is accomplished by a mechanical regenerator, operating in counterflow, which heats the entering air, after compression, to the temperature of the exhaust gases. Regenerative heating of the compressed air, however, increases the explosion and casing temperatures, or where the casing temperature remains constant, increases the amount of excess air essential for the prevention of excessively high temperatures.

A somewhat more satisfactory method of utilizing the heat content of the exhaust gases lies in the generation of steam of low- or medium-pressure. The steam can be used as the motivating force for a separate condensing steam turbine, or a turbine rotor mounted on a common shaft with the internal combustion turbine rotor, its energy being used to drive the compressor, although this particular application is not pertinent to aircraft adaptability. While the complication and weight of a powerplant of this type would be prohibitive for aircraft installation, the following suggested arrangement might prove feasible.

In the case of the constant pressure gas turbine, the steam may be expanded through the nozzles to the internal combustion turbine rotor, thus constituting an operating cycle for a combination gas and non-condensing steam turbine. The wet steam discharging at 212° F. serves as a medium for reducing the casing temperatures. Normally, the characteristics of this cycle would be assumed on a basis of a peripheral rotor velocity of approximately 800 ft. per sec. with a steam velocity coinciding with that of the gas velocity at 3600 ft. per sec., although due to the excessive steam pressure required (in excess of 1000 lbs. per sq. in.), the problem would be facilitated by using far lower steam-velocity values.

Reduction of casing temperatures by air cooling may be effected in both the explosion and constant pressure internal combustion turbines, and in this factor lies perhaps the most pertinent relation to the gas turbine's adaptability to aeronautical practice. The explosion-type lends itself admirably to this method of cooling, for as soon as a substantial pressure reduction is effected within the combustion chamber, cooling air may be forced against the turbine rotor being directed through the turbine nozzles before the cycle of operations is again resumed. Temperatures in the constant-pressure machine are prevented from becoming excessive by an excess of air. The application of air cooling thus imposes a considerable amount of negative work since power is required to motivate an air compressor. Air cooling also effects a substantial reduction in the temperature of the exhaust gases with a resultant lowering of the attainable steam plant efficiencies, and correspondingly lowered value of brake thermal efficiencies.

The internal combustion turbine may be operated with either liquid or gaseous fuels. Diesel-type fuel injectors could be applied for admitting the first form of fuel. The use of the second, or gaseous, form of fuel assumes a substantial increase in the negative work required since this fuel must be precompressed prior to admission to the turbine.



Temperature—entropy diagram for the internal combustion turbine cycle.

O-O' represents the axis of zero entropy, progressive changes in the characteristics of the working substance being designated by the displacements indicated. O-A indicates compression of the fresh charge adiabatically. O-A' indicates compression of the fresh charge isothermally. C indicates the initial point of combustion, the process following along the lines of constant volume or constant pressure as the case may be. B or B'-D indicates adiabatic expansion. E indicates the condition of the exhaust gases after being utilized for regenerative processes in cases where regeneration is employed.

A Business Builder for Transport Lines

the Sikorsky S-43 AMPHIBION TRANSPORT

● With current trials confirming the promise of its clean lines and sound design, this new 16-25 passenger ship indicates performances heretofore unattainable in multi-engined amphibions.

Airline traffic cannot but see the advantages of travel in amphibion equipment of comparable performance to the modern landplane transport. The ability to make waterfront landings and takeoffs enables the S-43 to materially reduce the elapsed time between cities. To eliminate such time wastage was a major design requirement of this newest Sikorsky product.

The possibilities for increased business in such reductions in travel time are obvious. Particularly in view of the care that has been taken to insure luxuriously comfortable accommodations for passengers in the most perfectly sound-proofed cabin yet designed.

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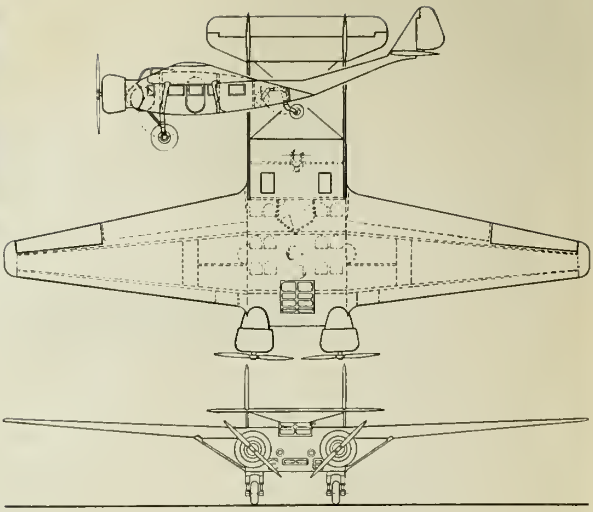

Burnelli Model UB-14 14-Passenger Transport

● Designed for passenger, mail and express service, the high-speed UB-14 developed by the Burnelli Aircraft Ltd., of Keyport, N. J., successfully passed its preliminary test flights last month.

The present plane is being especially fitted with special tanks and equipment for long range demonstration flights by Clyde Pangborn. Later it is planned to use the plane on a 'round the world trip, the plane to be refuelled enroute, four or five contacts being required to provide sufficient fuel for the journey. The date of the start will be determined after more complete demonstrations and cross country flights have been made.

Exhaustive wind tunnel tests at New York University, under the supervision of Dr. Alexander Klemin and verified by British Air Ministry research, showed the efficiency of the aerodynamic principles followed in the Burnelli lifting fuselage. Test flights made thus far have demonstrated the soundness of the claims made for the design, both as to efficiency in flight as well as structural advantages. Mr. Pangborn is particularly impressed with its stability and control qualities.

The new transport is of all-metal construction, using duralumin flat skin stressed. The skeleton structure is extruded dural section, and welded and heat-treated chrome molybdenum is used in the engine mounts, landing gear and main fittings.

In the Burnelli design, engines are housed side-by-side at the leading edge of the airfoil body or fuselage, sufficiently far apart to permit proper clearance between the propeller tips. The forward location of the engines, directly ahead of the passenger compartment and with the pilots between and aft, provides protection in the event of nosing over, since the engines would absorb major shocks. This protection is increased by having the propellers well forward of all structure. Safety is further increased by the wide and rigid formation of the body, with the engine structure and power plant weight protecting the rearward section with its greater resistance to buckling.

The arrangement of the engines and the attachment of the wings and landing gear simplifies design resulting in reduction in weight, costs of construction, and maintenance.

Cabin arrangement follows limousine practice, providing comfortable seating for 14 passengers in 556 cu. ft. of space; the cabin is 5 ft. 4 in. deep and 12 ft. long. Unobstructed view for the passengers has been made possible by the high wing placement. Entrance doors are provided on each side, with baggage compartments in the wings accessible therefrom for loading. Short bracing struts run from the lower part of the body to the wing, at the front and rear wing spars. A large express compartment is aft of the cabin, and the total express and baggage volume ordinarily available is 115 cu. ft.

Pilot accommodations are efficient and comfortable. The hatch housing the pilots slides back to provide closed or semi-open flying conditions. Vision is most satisfactory and lateral down view is enhanced by large windows below, located at each side of the pilots.

Hydraulic operation controls the landing gear and wing flap positions, augmented by an auxiliary manual control. The wheels may be retracted in 45 seconds and lowered in 12 seconds. Hydraulically-operated brakes may be applied simultaneously or individually. The retracting gear is not only visible to the pilots while in flight, but in the event of delay in the functioning of the operating mechanism, it is also easily reached for inspection and adjustment. The tail wheel is of the full 360° swiveling type and also is retractable, swinging in an arc forward and upward, similar to the landing gear.

The monoplane tail surfaces and one-piece elevator are carried on two outriggers extending from the upper rear section of the airfoil fuselage. The outriggers are made up of metal U sections, with intermediate bracing between and covered with flat plates at the sides. They are spaced 12 ft. 6 in. apart and cross braced with a Pratt truss of streamline wires. Two fins and balanced rudders are set above the stabilizer with full cantilever construction requiring no diagonal bracing members.

Powered by two P. & W. 680 h.p. Hornet direct drive engines equipped with Hamilton Standard controllable-

(*Continued on page 47*)

The Pratt & Whitney Hornet-powered Model UB-14 transport monoplane

UNITED AIR LINES CHOOSES GOODRICH TIRES FOR NEW, SPEEDIER 247D'S!

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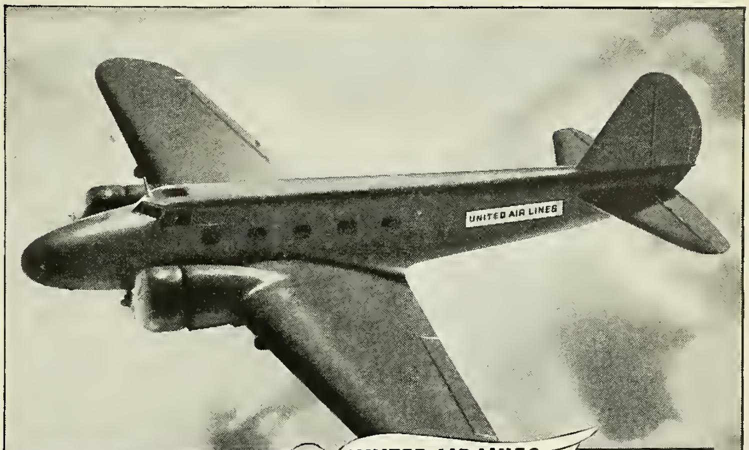
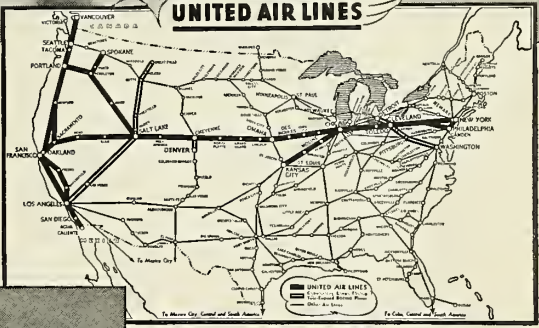
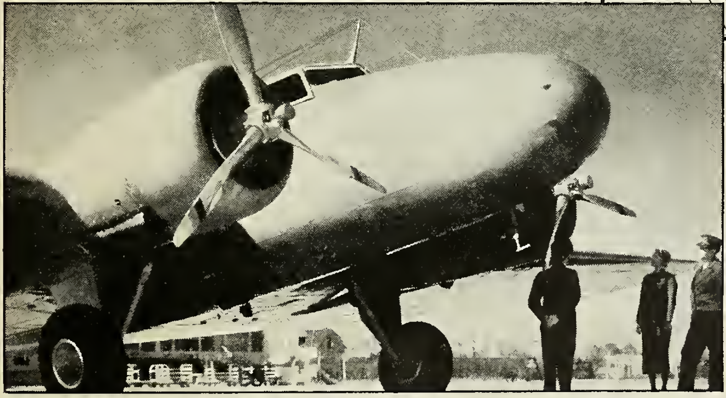






NEW OVERNIGHT COAST-TO-COAST BOEING 247D. Fastest plane ever flown under United's flag—top speed 202 m.p.h., can climb fully loaded to 11,200 feet on only one of its two Wasp engines. All planes are protected by 2-way radio communication . . . lighted airways . . . expert ground staffs . . . directive radio . . . and Goodrich Airplane Silvertowns for safe take-offs and landings.

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes—including Tires—Tail Wheels—Abrasion Shoes—De-Icers—Matting—Rubber Hose—Grommets—Shock Absorber Cord—A Complete line of Rubber Aeronautical Accessories.

CURRENT PRACTICE IN INSTRUMENT PANEL LAYOUT

● Every forward step in the development of aviation finds instruments playing an increasingly important part. Instrument flying (erroneously called "blind flying") is today practiced by practically every pilot. Confidence in the readings of the instrument panel has become an essential feature of flight training and technique. Appearance as well as utility has demanded as much skill and painstaking care in the design of instrument panels as in the design of the aircraft into which they are placed.

The Bureau of Air Commerce, prominently identifies with the various requirements for aircraft, both private and commercial, sections devoted to the types of instruments that must be installed. Section 72 (B) of the *Airworthiness Requirements for Aircraft* (Aeronautics Bulletin 7-A) states that "the equipment and instruments required, which shall be serviceable and in operating condition are: tachometer for each engine; oil pressure gauge where oil pressure systems are employed; oil thermometer for air-cooled engines or water thermometer for water-cooled engines; altimeter; manifold pressure gauge, (or equivalent) for each altitude engine. Section 72 (C) deals with compass requirements and requires "any airplane flying across country 100 or more miles, or operating over large bodies of water beyond the sight of land, to be equipped with a compass.

Bulletin 7-E, *Air Commerce Regulations Governing Scheduled Operations of Interstate Air Line Services* requires transport planes to be equipped with the instruments noted in Bulletin 7-A, in addition to (Chapter 4, Sec. 5): a turn and bank indicator; an instrument that will indicate the degree of bank and the altitude during climb and descent; an instrument that will indicate amount of turn; one compass properly damped and compensated; airspeed indicator, with electrically-heated pitot tube (or equivalent); rate of climb indicator; one approved sensitive-type altimeter, and one conventional type, both of which shall be adjustable for barometric pressure (the use of two sensitive-type altimeters is preferable); an approved free air thermometer, distance type, with indicating dial mounted in the pilot's compartment; and a clock.

In the following descriptions of instruments as installed on various panels as shown in the accompanying photographs, unless otherwise noted, they will be referred to from left to right, and top to bottom.

Sikorsky S-43

There are four sections in the instrument board of the S-43, newest of the Sikorsky amphibions. The center panel, as shown in the mock-up, has been reserved for a Sperry gyropilot, but if not used, will be made into a map or general utility cupboard.

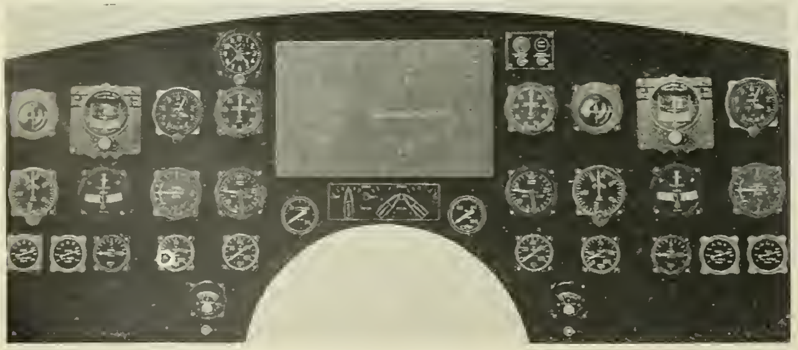
Engine instruments on the left are arranged in a reversed "L." Beginning at the top there is a clock, manifold pressure gauge, tachometer and oil pressure gauge. Across the bottom are the oil temperature indicator, fuel pressure gauge, and fuel quantity gauges for the left hand inboard and outboard tanks. Flight instruments on the left are a compass, Sperry directional gyro, altimeter, airspeed indicator, Pioneer turn and bank, and rate of climb indicators. The same general arrangement is followed on the right side of the panel, with engine instruments arranged in an "L". These include a duplicate set of instruments as found on the left panel with the exception of engine synchronizer and emergency booster switches which are in the same relative position as the clock. Another panel on the right side duplicates the flight instruments on the left side. When a gyropilot is used the instrument vacuum gauge and gyropilot pressure gauge are directly beneath. On either side of the panel centerline is an Evans thermocouple.

Sikorsky S-42

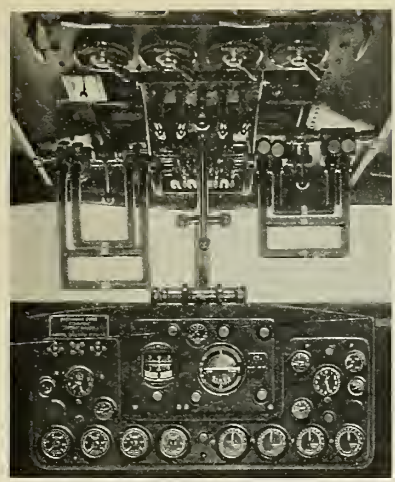
Because of the nature of the routes flown and because of the number in the crew, the Sikorsky S-42 Clipper Ships of Pan American Airways do not present the problems of instrument installation that other transports do. As the crew consists of a mechanic in addition to the pilot and co-pilot, the engine instruments are placed so that they do not interfere with the flight and navigation instruments needed by the pilots. Instead, they are mounted on the bulkhead in the rear lefthand corner of the pilots' cockpit where the mechanic can make direct reference to them without disturbing the pilots.

There are also other instruments on another separate and individual mounting, —the thermocouple switch and laboratory-type potentiometer which are in the cockpit on a hinged table which may also be used to make notes, etc. The light from the engine instrument board is sufficient to care for these instruments.

The main flight instrument board consists of three sections—the center panel and the two outer panels. The center



Mock-up illustrating instrument installation on the Sikorsky S-43 amphibion



Pan American's Sikorsky S-42

panel in the shape of a flattened "U", is the largest of the boards and is in the centerline of the plane, slightly to the right and left of the pilot and co-pilot respectively.

Center panel (center): Sperry directional gyro, Sperry gyropilot.

Left center panel: three speed control valves; rheostat, a Pioneer-Waltham clock; flap system pressure gauge, light.

Right center panel: Pioneer vacuum instrument suction gauge, Sperry gyropilot pressure gauge, Pioneer-Waltham clock, rheostat, Pioneer flap system pressure gauge.

Bottom center panel: four General Electric tachometers, light, switch, four Pioneer manifold pressure gauges.

Ten inches further back and directly in the centerline of the pilots are two similar instrument panels, one for each pilot.

Top: Pioneer compass, Sperry directional gyro, Kollsman sensitive altimeter; Pioneer airspeed indicator, Pioneer turn and bank indicator, Pioneer rate of climb indicator. Two lights, one on each side of the panel illuminate the instruments for night observations.

Simplicity is also the keynote of the mechanic's instrument panel. Each engine's instruments are alined downward under a nameplate which designates the engine. These nameplates are arrayed across the top of the panel. Directly underneath are four General Electric oil pressure indicators, and below them are the General Electric oil temperature indicators. The following two rows are for the Nagel fuel quantity gauges, while directly beneath these are the General Electric fuel pressure gauges. In the lower left corner there is a flap gauge, and directly to the right a diagrammatic plate showing the position of the fuel tanks in the wing.

Martin Flying Boat

The accompanying photograph was taken of the instrument panel prior to installation in the new Pan American Airways Clipper Ship No. 7. It clearly shows the arrangement of the panel and the ease with which the instruments can be maintained.

The panel, complete with instruments and Sperry gyropilot control unit, weighs 91.5 lbs., and is attached to the structure by 9 bolts, mounted on Lord sheer mountings to eliminate vibration, 4 pairs of shock absorbers being installed on each end of the panel. There is also a fore and aft stabilizing rubber mount at the bottom of the board. The interior of the board is painted white, and the compartments are flooded with 6 c.p. clear lamps. Instruments are spaced back 1/16″ from the cover panel. Holes in the face of the panel are flanged, and a green pyralin ring is installed between each instrument and the cover panel. The white light in the compartments changes to green as it goes through the rings and is reflected on the instruments. No direct light shines from the instrument board, and there are no shadows on the instruments, resulting in a mellow glow which provides excellent visibility at night since there is no light contrast between the panel and the interior of the cockpit. At the same time, instruments are clearly visible to the pilot.

Directly on top of the panel is the Sperry gyro-horizon.

Upper center: Sperry gyropilot. Upper left and upper right panels: duplicate set of flight instruments; Pioneer compass, Sperry directional gyro, Kollsman sensitive altimeter; Pioneer airspeed, and turn and bank indicators, rate of climb indicator. Lower center panel: four General Electric tachometers; four Pioneer manifold pressure gauges. A Pioneer clock is to the left of these instruments in the same panel, and slightly to the left and above is the rheostat for the gyropilot.

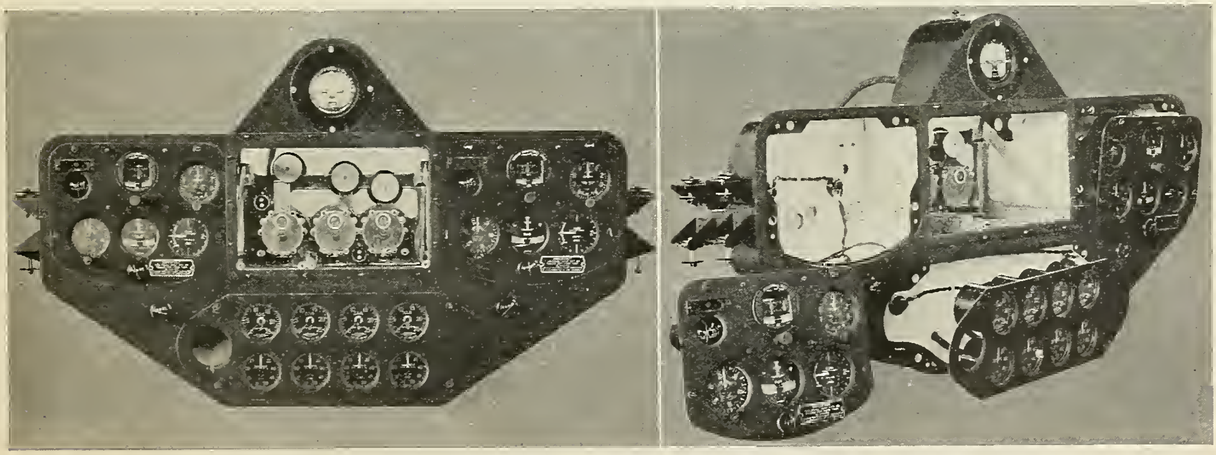
To the right and above the lower panel is the rheostat for the engine instrument lights. Each panel has its own individual rheostat.

Lockheed Electra

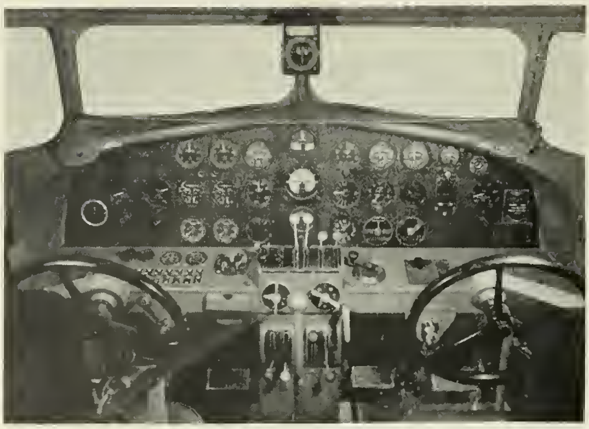
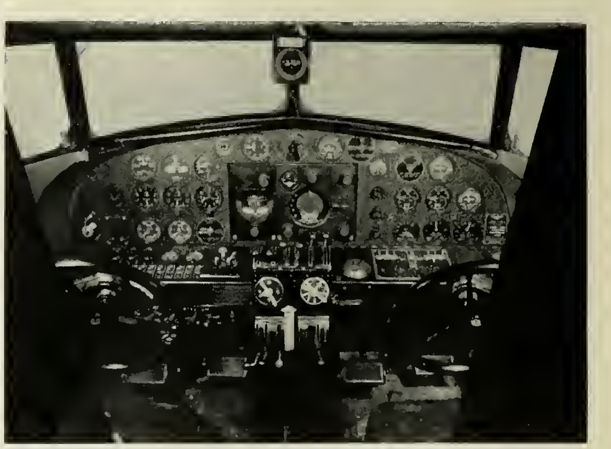
Instrument installations on the bi-motored Electra transport follow the dictates of the purchaser, although the company has a standard layout which is followed unless otherwise specified.

The installation illustrated is the board of the first Electras; since then Kollsman instruments have replaced all other types with the exception of the gyroscopic and electrical types. The panel shown is arranged in three rows across the board which extends the full width of the fuselage. Painted a crackled black, (or in special finish as desired), the board is on a flexible rubber mount and is indirectly lighted with rheostat-control for night flying.

Above, and in the vee of the windshield, is the compass. Below the board are the electrical and radio panels, fuse boxes, etc., the former containing the engine starter buttons, ignition switches, ammeter, voltmeter and switches for all lights except the passengers' individual



Glenn L. Martin clipper ship installation, showing how separate group units may be removed for inspection

Lockheed Electra with standard installation of instruments, and at the right with the Sperry gyropilot installed

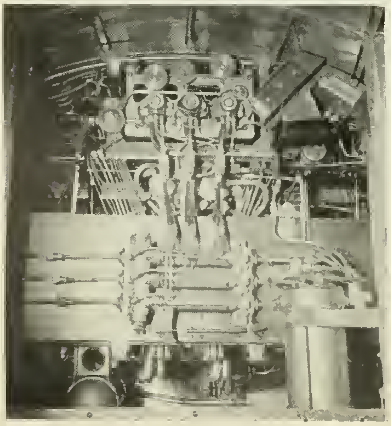
reading lights which are controlled by the passenger.

The board is removable as a unit and is suspended in place by Lord shear rubber mountings to prevent vibration. Ahead of the board is the rear wall of the nose baggage compartment, the wall being fixed in place by Dzus fasteners, and being quickly removable for access to the unexposed rear section of the instrument board. A separate radio panel is provided in the cockpit in front of and below the instrument board ahead of the right-hand seat.

Top row: two manifold pressure gauges, temperature gauge, turn and bank indicator, Kollsman altimeter, Weston electric air temperature indicator, Weston cabin temperature indicator, and Weston carburetor air temperature indicator. The passenger service light is at the far right.

Second row: left and right wing-tank fuel indicators, two Kollsman engine gauge unit combination oil, fuel, and temperature indicators, airspeed indicator, Sperry gyro-horizon, rate of climb indicator, wing flap position indicator.

Third row: two fuel gauge air pump knobs, two Weston electric tachometers, right and left engine temperature selector switch, Sperry directional gyro, Waltham clock, turn and bank venturi valve control, altimeter valve control. The fuselage-tank fuel indicator pump knob is at the extreme right.



Reverse side of Electra's Sperry Gyropilot

The special panel is somewhat similar to the standard installation, with the exception of the Sperry gyropilot which occupies the direct central portion of the board. This necessitates a change in the arrangement of the instruments. Directly above the Sperry panel is the passenger service light, manifold pressure gauge, Weston engine temperature selector switch, temperature indicator, turn and bank venturi valve control, and carburetor air temperature instrument switch.

Left group: airspeed indicator, turn and bank indicator, rate of climb indicator, flap position indicator, two Kollsman sensitive altimeters, Waltham clock, Lunkenheimer primer, landing gear position indicator, two Weston electric tachometers, manifold gauge, and vacuum pump control.

Right group: Weston carburetor air temperature indicator, altimeter valve control, Weston cabin temperature indicator, two Kollsman engine gauge unit combination oil, fuel and temperature indicators, Weston air temperature indicator, wing-tank and fuselage-tank fuel quantity indicators. The respective fuel gauge pump knobs are directly to the left of the instruments to the right of the Sperry panel. Except as noted, instruments are of Pioneer manufacture.

In the special installation, the electrical and radio panels are in the same position as in the standard arrangement.

Boeing 247-D

The three panels of the Boeing 247-D transport's instrument board are connected through shock absorbers and the assembly is mounted in the airplane on shock absorbers.

All instruments are so installed as to be readily visible to the pilot without artificial illumination during daylight hours; for night operations they have luminous markings and are indirectly lighted. The lights consist of hooded floodlights with clarostat control operated by "on" and "off" switches. In addition, there is a pushbutton switch on the inboard end of each control wheel rim by which the instrument lights may be turned on regardless of the position of the main switch.

Flexible connections are used in the lines to the directional gyro and gyro-horizon. Pressure instruments are equipped with a restricting plug to dampen pulsations, and 4-SO aluminum is used for all instrument tubing. Connections in the airspeed indicator are made with Parker aluminum alloy fittings.

Pitot-static tubes for the airspeed indicator are mounted under the nose of the fuselage in a position which obtains correct functioning of the instrument, the tube being equipped with a heating element to prevent ice formation. This element is controlled by a switch in the cockpit and is of Pioneer make.

Four direct-reading thermocouples are installed on the two engines. These are mounted on the heads of No. 1 and No. 4 cylinders of each engine. A ten-point selector switch is in the cockpit near the indicator, so that the cylinder head temperature of any one of the above cylinders may be read on the indicator. This selector switch and indicator is used for the carburetor air intake thermocouples.

Directional gyro and gyro-horizon vacuum driven instruments are connected to a vacuum pump on the right engine. The turn and bank indicator is connected to the induction chamber of the left engine.

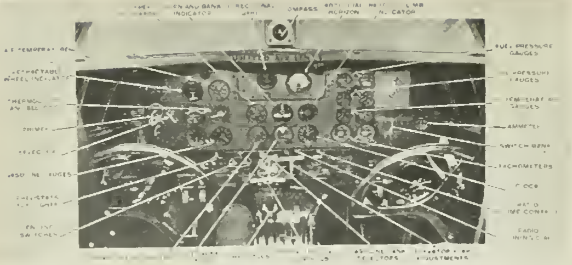
The oil thermometer is installed in a thermometer well in the oil inlet line; the fuel pressure gauge is connected to the lines leading to the relief by-pass valves, the fuel pressure alarm units to the fuel pressure gauge lines, the altimeter orifice, together with that of the rate of climb indicator to the airspeed indicator

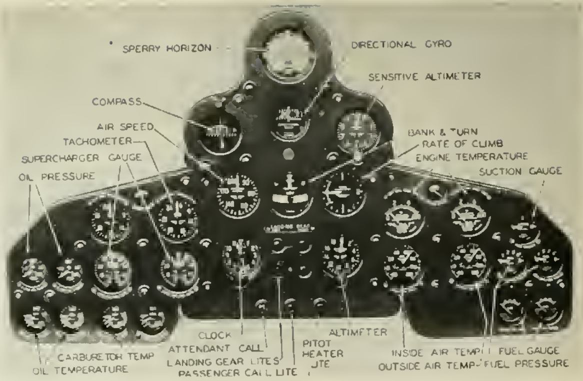
(Continued on following page)

The complete line of Weston Aircraft Instruments is illustrated and described in this new bulletin. Copies are available on request.

Over 90% of the air transport mileage is flown with WESTON AIRCRAFT Instruments

WESTON Instruments





Above is the panel of a United Airlines Boeing, with the principal instruments indicated. The view at the right shows the standard installation on the Curtiss Wright Condor as used on American Airlines

(Continued from preceding page)

static line, and the ice warning thermometer bulb is mounted on the forward side of the windshield Vee.

Left panel: landing gear position indicator, ice warning thermometer; thermometer, selector switch; two fuel gauges. The parking brake lever, selector switch, primer, and fuel gauge pump knobs are to the left of these instruments.

Center panel: Sperry directional gyro, Sperry gyro-horizon; airspeed indicator, Pioneer turn and bank and rate of climb indicator; Kollsman sensitive altimeter, manifold pressure gauge, Pioneer clock.

Right panel: two fuel pressure gauges; two oil pressure gauges; two oil temperature gauges; two tachometers. The switch bank and ammeter are at the right.

The control board is directly below and forward of the instrument panel. It contains on the left hand side the rheostats for light and the engine switches; in the center is the propeller pitch controls, fuel tank selector, elevator flap adjustments and radio tuning dial; and on the right is the radio volume controls, the radio fuse box and the receiving and transmitting switches.

Curtiss-Wright Condor

Flight instruments on the Curtiss-Wright Condor transport planes are grouped together on a panel which is so mounted that it extends beyond the main instrument panel. Top panel: Sperry gyro-horizon; compass, Sperry directional gyro, Kollsman sensitive altimeter; Pioneer airspeed, and turn and bank indicator, Pioneer rate of climb indicator.

Engine and other instruments are on the main panel and the engine controls, consisting of throttles, mixture and carburetor heater levers, are between the pilot's and co-pilot's seats.

Left panel: right and left engine tachometer; left engine oil pressure gauge, right engine oil pressure gauge, left engine manifold pressure gauge, and right engine pressure gauge; left and right engine oil temperature gauge, left and right engine carburetor air temperature gauge. Directly above the switches and fuse box and in the center of the panel is the clock and standard altimeter; above these instruments, the propeller indicator and propeller control gauge.

Right panel: left and right engine head temperature gauges, suction gauge; cabin temperature gauge, outside air temperature gauge, two fuel pressure gauges; two fuel quantity gauges.

If the throttles are cut below the minimum revolutions required to sustain altitude while the landing gear is in the retracted position a warning bell rings. Simultaneously two red lights flash on the main instrument board, and continue to burn until the gear has been brought to its proper position. When the gear is in an extended position, two green lights flash on the board. Other lights include a pitot heater indicator and passenger call indicator. Rheostats for controlling instrument lights are in the upper left and upper right center of the main panel.

The Condor instrument board is mounted on felt and is removable in sections.

Lockheed "Winnie Mae"

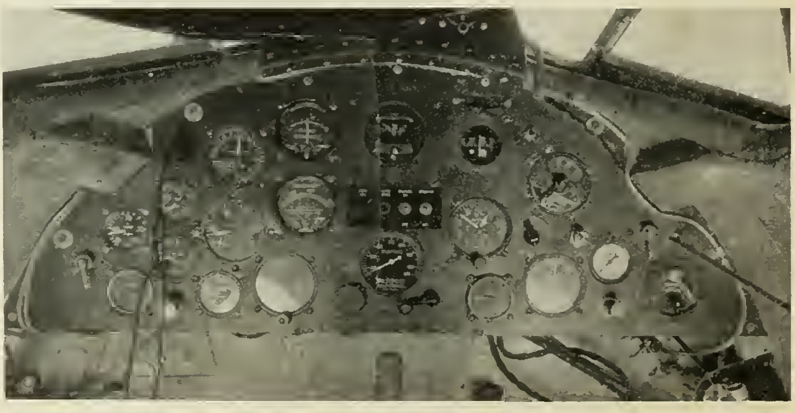
Interest in the equipment and accessories of the *Winnie Mae* increased tremendously since Wiley Post undertook his flights in the stratosphere. Aside from the curiosity surrounding Post's stratosphere suit, the arrangement of the plane's interior has created considerable conjecture, especially since photographs or descriptions have not been published before. The accompanying photograph shows the main instrument panel of the *Winnie Mae.*

Above the panel shown in the photograph is a General Electric compass, fuel pressure gauge, and Wittnauer clock. Directly in the center of the main instrument panel are the Sperry directional gyro, switch panel, and radio compass dial, with tuning and volume controls.

Left of center panel: radio compass indicator, Weston electric temperature indicator, airspeed indicator; supercharger pressure gauge, tachometer, temperature gauge; oil and fuel pressure gauges. Oil temperature and fuel pressure gauges are in the furthermost left corner.

Right of center panel: compass, Kollsman sensitive altimeter, fuel pressure gauge; General Electric controller for compass, General Electric sensitivity control, Kollsman manifold pressure gauge. Directly to the right of the last row of instruments is an Air Products oxygen gauge, and at the extreme right, the Scintilla ignition switch. Except as otherwise noted, instruments are of Pioneer manufacture. A lever at the left, below the panel, is used to turn the propeller to the horizontal position upon landing on the skid; to the right is the landing gear release lever.

(To be continued in September)



Instrument panel of Wiley Post's Vega, "Winnie Mae," equipped for stratosphere flight

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valve to allow the use of a wabble
np in connection with the mechanical
np. The valve developed consisted of
pool type valve having one end of the
ol as a pressure valve for the sylphon.
the other end of the spool a series of
holes were drilled and covered on the
ssure side by a small valve, thus allow-
a perfect valve seal. When the pump
s operating, the valve covering the six
es was pressed tight against this end
the spool by both a spring pressure and
oline pressure thus allowing the press-
relief valve proper to operate, and
en the wabble pump was used the fuel

	45 feet
Height overall	10 feet 4 inches
Wing chord, root	14 feet
Wing chord, tip	4.5 feet
Lifting area	686 square feet
Payload	3200 pounds
Weight empty	8200 pounds
Weight loaded	14,200 pounds
Wing loading	20.4 lbs./sq. ft.
Power loading	9.65 lbs./h.p.
Fuel capacity	300 gallons
Oil capacity	25 gallons
Performances at Sea Level	
Maximum speed	210 miles per hour
Cruising speed	185 miles per hour
Landing speed	63 miles per hour

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WACO LEADS IN AIRCRAFT REGISTRATION

Fairchild Super 71 Seaplane

Since 75 per cent of Canadian aircraft are operated on floats during the summer season and on skiis during the winter, the Fairchild "Super 71" was primarily designed as a seaplane, and its float equipment was given primary consideration by its designers

Loading heavy barrels aboard the Super 71

● Fairchild Aircraft Ltd., the Longueuil, Quebec subsidiary of Fairchild Aviation Corp., recently completed a new high wing seaplane designed for passenger or cargo-carrying operations. Known as the Super 71, this all-metal machine is convertible into a transport with accommodations for eight passengers, or a cargo plane which can carry 2000 pounds of payload for 600 miles at a cruising speed of 121 m.p.h.

Fuselage construction is of a series of aluminum alloy rings interconnected with aluminum alloy intercostal Z-bars, the whole being covered with a smooth skin of the same material. Wing construction follows the fabric-covered spruce design used in previous "71" types.

Clear floor space in the cabin measures 13 ft. 6 in. long by a maximum width of 5 ft., giving a total cabin space of at least 200 cu. ft. An additional door is on the starboard side for the use of passengers, and an emergency escape hatch is in the roof at the forward end.

Wide seats, with adjustable backs and ample leg room are provided for passengers. Cabin walls are insulated against heat and cold, and a heating system for the cockpit and cabin is incorporated in the fuselage structure. Windows are set in rubber gaskets, and the doors close on sponge rubber seals.

The cockpit is at the rear of the cabin and is equipped with a semi-circular transparent and adjustable sliding roof. In this cockpit is an adjustable sliding parachute seat and the instrument panel which is mounted on anti-vibration pads. In addition to the required flight and engine instruments, there is a thermocouple unit, boost gauge, voltmeter, ammeter, rate of climb indicator, turn and bank indicator and other necessary instruments.

Although equipped with a single control, pilots may change places while in flight by means of two doors in the pilot's compartment bulkhead.

The Pratt & Whitney T1D1 engine (520 h.p. at 2100 r.p.m.) is carried on anti-vibration rubber mountings and the engine mount is easily detachable from the fuselage.

An engine cowling which completely encloses the engine and provides adjustment of engine temperature, is utilized. In its nose is a dual shutter, regulated from the cockpit, which gives independent regulation of both the crankcase and cylinder head temperatures. In addition, an oil cooler gives further temperature control. The cowling is so arranged that the top, sides and rear of the engine are easily accessible. Further protection of the engine and assurance of operating under the extreme operating range experienced in Canada, is provided by overhead carburetor air intakes and complete preheating equipment. A stainless steel exhaust manifold also is installed.

Fuel is supplied by direct gravity from three tanks situated in the wings, and clear of the fuselage. Each tank is equipped with a shut-off cock controllable from the cockpit. Fuel lines run from the tanks to the carburetor without passing through the cabin, and a water separator (supplementary to the standard filter) is at the lowest point of the fuel system.

The oil supply is in an aluminum tank immediately behind and connected to the engine by flexible tubing and the oil system is equipped with a quick-dumping drain valve.

An inspection door is in the fireproof bulkhead which is also the front cabin bulkhead. Through this door, access is obtained to the rear of the engine, and to the accessories for inspection and service.

Flight controls are of non-flexible cable with chain passing over ball-bearing sprockets. Controls from the cockpit to the engine are housed in two ducts running along the outside of the cabin's top.

The plane is bonded for radio and there is space beside the pilot for the installation of radio receiving equipment. Storage space for operating gear, tools, anchor, rope, etc., is available in the stub wings, and a chute for dropping mail bags is incorporated in the main cabin door.

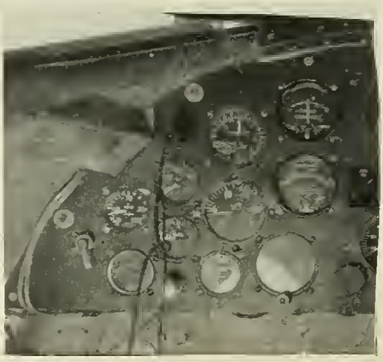
Specifications and performance figures of the Fairchild Super "71" as a seaplane are as follows:

Wing span	58 feet
Length overall	35 feet 6 inches
Height overall	13 feet
Wing area	392 square feet
Power loading	13.45 lbs./h.p.
Wing loading	17.85 lbs./sq. ft.
Empty weight	4220 pounds
Useful load	2780 pounds
Gross weight	7000 pounds
Maximum speed	141 miles per hour
Cruising speed	121 miles per hour
Landing speed	58 miles per hour
Rate of climb	800 feet per minute
Cruising range	760 miles

gyro-horizon; compass, Sperry directional gyro, Kollsman sensitive altimeter; Pioneer airspeed, and turn and bank indicator, Pioneer rate of climb indicator.

Engine and other instruments are on the main panel and the engine controls, consisting of throttles, mixture and carburetor heater levers, are between the pilot's and co-pilot's seats.

Left panel: right and left engine tachometer; left engine oil pressure gauge, right engine oil pressure gauge, left engine manifold pressure gauge, and right engine pressure gauge; left and right engine oil temperature gauge, left and



The Canadian-built Fairchild Super 71 seaplane powered by a P. & W. engine

RECENT PATENTS

(*Continued from page* 35)

Variable propeller. Forrest M. Kent, Spokane, Mich. (2,005,343)

Aircraft deviation indicator. Charles Marcus, New York, N. Y., assignor to Eclipse Aviation Corp. (2,005,379)

Automatic control device for aircraft. Johann M. Boykow, Berlin-Lichterfelde-West, Germany. (2,005,530)

Aircraft landing wheels. Alger G. Miranville, Akron, Ohio, assignor to General Tire & Rubber Co. (2,005,626 and 2,005,627)

Inclinometer. Edward C. Potterf, Noti, Oreg. (2,005,634)

Amphibian. Walter K. Burgess, Chanute Field, Ill. (2,005,728)

Parachute pack. Edward L. Hoffman, Dayton, Ohio. (2,005,743)

Airfoil control means. George E. Barnhart, Pasadena, Calif. (2,005,965)

Retractable landing gear. Robert J. Minshall, Seattle, Wash., assignor to Boeing Airplane Co. (2,005,980)

Gyroscopic turn indicator. George H. Reid, Kingston-on-Thames, England. (2,006,112)

Navigation instrument. Victor B. Buck, New York, N. Y. (2,006,127)

Airplane controls. Zantford D. Granville (deceased), West Springfield, Mass. (2,006,391)

Airplane fuselage. Albin K. Longren, Kansas City Airport, Mo. (2,006,468)

Flying-time and like indicator. Howard C. Mayers, London, England. (2,006,682)

System for landing aircraft. Walter M. Hahnemann, Berlin-Marienfelde, Germany. (2,006,918)

Landing field localizer. Louis Cohen, Joseph I. McMullen, and Joseph O. Mauborgne, Washington, D. C. (2,007,076)

Airplane. Theodore P. Hall, Kenmore, N. Y. (2,007,086)

Automatic aerodynamic stabilizer for airplanes. Otto E. Bemberg, Paris, France. (2,007,106)

Airplane. Louis Wurth, Miami, Fla. (2,007,319)

Air propeller with variable pitch. Jacques Aivaz, Paris, France. (2,007,417)

Radio-controlled navigation apparatus. Frederick E. Nickel, San Diego, Calif. (2,007,477)

Parachute. George G. Coleman, County Line, Okla. (2,007,494)

Propeller. Marshall A. Smith, Jr., South Bend, Ind., assignor to Benedix Aviation Corp. (2,007,506)

Method of and appartus for automatic aircraft control. Guido Wunsch and Waldemar Moller, Germany. (2,007,515)

Landing gear for aircraft. Alexander P. de Seversky, New York, N. Y., assignor to Seversky Aircraft Corp. (2,007,752)

Method of making aircraft propellers, and airplane propeller. Samuel H. Smith, Rocky River, Ohio, assignor to Aviation Mfg. Corp., Chicago, Ill. (2,007,775 and 2,007,776)

Aircraft. Henry Schulman, Pangbourne, England. (2,007,878)

FUEL PUMPS

(*Continued from page* 32)

developed the pump known as the E-7 which eliminated the excessive tubing and complicated connections previously found on all types of aircraft.

This was accomplished by placing a relief valve in the pump and also another valve which allowed one line to be used from the supply tank to the mechanical pump and through it to the carburetor. With this type of construction, external relief valves and extra tubing were eliminated and only one line was used for the entire fuel system.

However, it was found that, although this type of relief valve met the requirements for straight flying, in military ships where a great deal of maneuvering is done the pressure tended to vary from 1 to 3 pounds, depending on the position of the ship. To solve this, a sylphon valve was developed to maintain a constant pressure regardless of the flight position.

This valve consists of a sylphon bellows put in a chamber on the suction side of the pump and having a tapered valve resting on a tapered seat. Because the inside of the sylphon is opened to atmosphere, the suction created by the pump does not affect the valve opening at anytime and the vacuum can be run from —6" to + 14" of mercury without any appreciable change in the pressure to the carburetor. This was advantageous because the float mechanism sensitivity was not versatile enough to sustain any large variation in pressure and still give efficient carburization.

The sylphon presented difficulties in wabbling through the pump which were not foreseen and many months were spent developing a valve which could be used in conjunction with the main pressure relief valve to allow the use of a wabble pump in connection with the mechanical pump. The valve developed consisted of a spool type valve having one end of the spool as a pressure valve for the sylphon. In the other end of the spool a series of six holes were drilled and covered on the pressure side by a small valve, thus allowing a perfect valve seal. When the pump was operating, the valve covering the six holes was pressed tight against this end of the spool by both a spring pressure and gasoline pressure thus allowing the pressure relief valve proper to operate, and when the wabble pump was used the fuel flowed around the sylphon between the two ends of the spool through the six holes and in turn pushed the small valve off its seat allowing the fuel to be wabbled through the pump to the carburetor.

The latest development in aircraft fuel pumps is the Evans E-9. The unit incorporates an improved sylphon relief valve having an integral wabble valve which permits fuel to pass through the engine driven pump and reduces the usual complicated piping to a single feed line. It gives better performance due to the fact that the correct carburetor pressure will be maintained regardless of flying position, as indicated in figure 1 which shows the sharp drop in discharge pressure produced by a rise in suction on the conventional spring operated valve. Figure 2 presents the results obtained with the E-9. Pressure valves remain unchanged even with two pounds of pressure imposed on the suction of this pump. Valves are kept in line with their seats by steel pilot bushings, insuring accurate seating and priming at low speeds.

It has only been within the last five or six years that concentrated effort has been put on the development of aircraft fuel pumps, and it will be seen that such development has taken long strides towards perfection. Constant improvement in aircraft fuel pumps continues because of the vital necessity of a reliable, efficient and fool-proof heart for the engine.

BURNELLI UB-14

(*Continued from page* 38)

pitch propellers, the UB-14 has a maximum speed at sea level of 210 m.p.h. At 10,000 feet, its maximum speed is estimated at 225 m.p.h., while on one engine at 7,000 feet, a speed of 150 m.p.h. can be attained. Cruising speed at 10,000 feet is 200 m.p.h.

Engine rear sections are accessible in flight, allowing inspection and minor repairs while in the air; fuel, oil and control leads to the engine are easily visible and accessible to the pilots.

Specifications and performance figures for the UB-14 are as follows:

Specifications

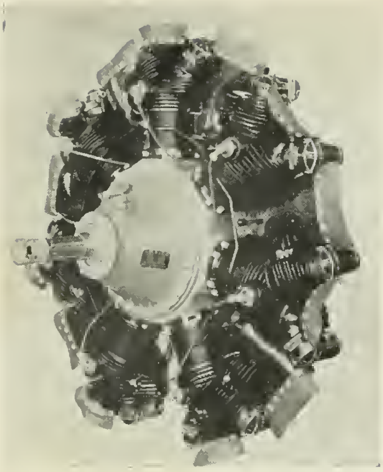
Wing span	71 feet 2 inches
Length overall	43 feet
Height overall	10 feet 4 inches
Wing chord, root	14 feet
Wing chord, tip	4.5 feet
Lifting area	686 square feet
Payload	3200 pounds
Weight empty	8200 pounds
Weight loaded	14,200 pounds
Wing loading	20.4 lbs./sq. ft.
Power loading	9.65 lbs./h.p.
Fuel capacity	300 gallons
Oil capacity	25 gallons

Performances at Sea Level

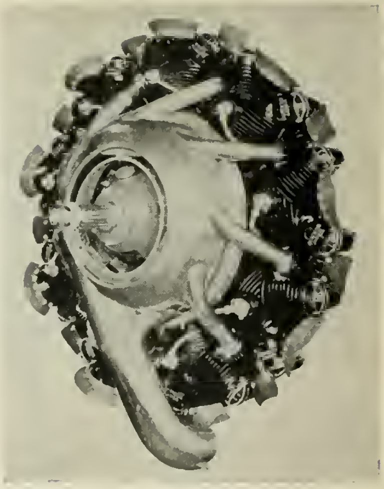
Maximum speed	210 miles per hour
Cruising speed	185 miles per hour
Landing speed	63 miles per hour
Rate of climb	1250 feet per minute
Service ceiling	22,000 feet
Cruising range	600 miles

Supercharged Wright Whirlwind 7- and 9-Cylinder Altitude Series Engines

●



The 7-cylinder Whirlwind engine equipped for a rear exhaust system



The 9-cylinder Whirlwind equipped with stainless steel exhaust manifold

Under a recent Department of Commerce ruling, the pilot or aircraft manufacturer can get increased performance by installing an "oversized" engine to provide additional power to fly at higher altitudes.

For example, if an airplane is stressed for 140 m.p.h. at sea level with a 200 h.p. engine, this airplane will be safe to fly at 140 m.p.h. indicated airspeed at any altitude. Hence, an engine rated at 320 h.p. at sea level could be installed in the plane as long as the pilot did not open the throttle so as to exceed the 140 m.p.h. indicated airspeed limit. The additional power enables the pilot to open his throttle further and further as altitude was increased until the airspeed meter reads 140 m.p.h. at any altitude. The Department also ruled that if the plane meets certain analysis requirements, the pilot may throttle to the maximum permissible engine power for take-off and climb.

● Wright Aeronautical Corp. has just announced a new series of Whirlwind engines which provide a wide range of power ratings, and which enable private owners to avail themselves of additional power to fly at higher altitudes for faster, economical cruising, in accordance with a new ruling of the Department of Commerce.

These engines are divided into two groups—the 7-cylinder and the 9-cylinder series—with an approved take-off rating covering a range of 235 h.p. to 440 h.p. Aside from the difference in displacement, these Whirlwinds are identical both as to their fundamental design and construction. In addition, ninety per cent of their parts are interchangeable. The principal differences between models of the same series, regardless of performance, are in the amount of supercharging applied and the compression ratio of the pistons.

The 7-cylinder Whirlwinds are designated by their cubic inch displacement as the R-760-E series engines. The four engines of this series, differing only with respect to the amount of supercharging applied, provide a power range from 235 h.p. to 320 h.p. Only one unsupercharged model is offered—the Whirlwind 235 h.p. Trainer (R-760-ET) built primarily for military training planes of the U. S. Army primary trainer type.

The moderately supercharged Whirlwind R-760-E is rated 250 h.p. at sea level, while the R-760-E1, with high compression pistons, produces 285 h.p. at sea level. The fully supercharged R-760-E2 is rated 320 h.p. at sea level, and under the new Department of Commerce ruling, either the Whirlwind 285 or the Whirlwind 320 may be installed in a plane originally designed for the Whirlwind 250.

A feature of the 7-cylinder engines is the No. 20 spline crankshaft which has replaced the No. 30 spline shaft previously used, a refinement which makes possible weight saving of approximately 48 lbs. by permitting the use of a lighter and more efficient controllable propeller hub.

Under conditions simulating flight operation, the 285 h.p. model was run at speeds ranging from idling to full throttle for 400 hours without forced stops, adjustment or servicing. At the completion of this run, the engined turned up full rated power, and when torn down and inspected, was found capable of operating for another 100 hours before an overhaul would have been necessary.

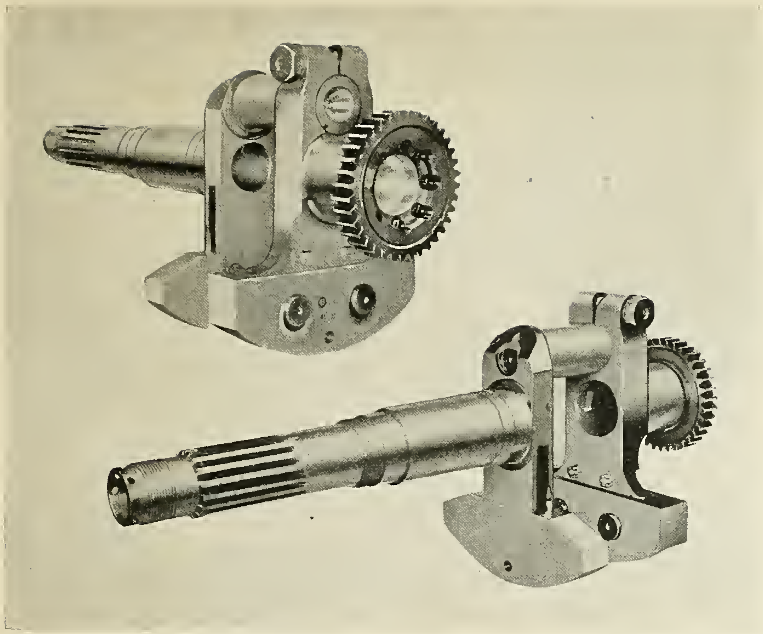
A take-off power range from 330 h.p. to 440 h.p. is covered by the 9-cylinder models. All are of 975 cubic inch displacement, and are identical except for the amount of supercharging applied. Ground boosted for improved performance at take-off, the 9-cylinder R-975-E is rated 330 h.p.; while, with high compression pistons, the R-975-E1 delivers 365 h.p. at sea level. The fully supercharged and high compression piston equipped model R-975-E3 is rated 420 h.p. at sea level with 440 h.p. for take-off.

The new Whirlwinds are provided with a number of mechanical innovations developed for the Wright Series F and F-50 Cyclones. These features have improved performance, both at sea level and high altitudes, and have produced smooth operation, increased dependability and economy.

They are equipped with the dynamic dampner described in the June, 1935, issue of Aero Digest, and inter-cylinder and cylinder head air deflectors which provide full pressure baffling on all supercharged models. These baffles force the cooling air to follow closely the contours of the cylinder barrels and heads and insure efficient cooling in tightly cowled installations. Each baffle is individually detachable, permitting the removal of any one cylinder or group of cylinders without removing all baffles.

The new Whirlwinds may be fitted

Supercharger of the new Whirlwinds



Crankshaft showing dynamic damper, spring-coupled accessory drive, lengthened propeller shaft, and improved seating for rear propeller cone

with any type of controllable or fixed pitch propeller and control mechanism for propellers of the hydro-controllable type is built into the nose section of the crankcase. A two-way valve provides for regulation of the engine oil pressure to change the pitch as desired.

Crankshafts have been lengthened to bring the splines forward of the rear propeller cone, providing better seating surface for the
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Cleansing of engine oil is assured by a Cuno piled-disc type oil filter (standard equipment). The filter need not be removed from the engine for cleaning except at the end of an overhaul period, and is so constructed that all foreign matter may be removed from the discs after every ten hours of operation by a complete turn of a handle provided for that purpose.

Cylinders are built up of a forged steel barrel and a cast aluminum head. Cooling fins are so disposed as to provide efficient cooling under all conditions.

Side exhaust ports, which permit the use of either a front or a rear exhaust system, are provided. Detachable finned elbows are supplied to direct the exhaust gases to the front or rear of the engine, and elbows provided as standard equipment are for use with a front exhaust collector.

Rocker support boxes are cast integral with the cylinder head and are equipped with covers held in place by clamps, which are readily removable. The covers form a rigid support for the installation of an anti-drag ring type cowl, and eliminate the necessity of brackets.

The crankcase consists of five major castings of light high tensile a
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Construction Details of Consolidated Fleet Trainers

● The two-place open cockpit Fleet biplane manufactured by the Consolidated Aircraft Corp., is available in four models, each basically similar, but varying as to engine installation and modifications in fuel tank arrangements, armament, floats, and special wings for altitude flying. These models and their engines are the Model 10, powered by a 125 h.p. Kinner B-5; the Model 11, powered by a 160 h.p. Kinner R-5; the Model 11 Special, powered by a Kinner R-5 delivering 150 h.p. at 6000 ft., and the Model 10-G, powered by a 130 h.p. Gipsy Major engine.

The modifications of the basic model are: belly tank providing 25 gallons additional fuel, fuselage tank in front cockpit holding 35 gallons; fixed machine gun installation; one A-3 bomb rack under fuselage, (when bomb rack is carried, belly tank cannot be installed); two A-3 bomb racks under lower wing panels (applicable only to Model 11); seaplane
and special wings for high
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also provided at the tail for accessibility to stabilizer adjustment and supports, and fin adjustments; under the fuselage aft of the fire wall to facilitate cleaning the fuselage; and forward of the fire wall. A side cowling gives access to the rear of the fire wall bulkhead.

The two seats are arranged in tandem, and are of metal, designed to take seat-type parachutes. They are fastened directly to the fuselage structure. Quickly-removable dual stick controls are attached to an intercockpit torque tube and are connected by the elevator operating through the torque tube. Ailerons are operated through a lever attached to the rear end of the torque tube, and the elevators through an operating tube connecting the elevator horn to the rear stick.

Control system bearings are renewable bronze-to-steel. Brakes are independently operated through cables in Bowden casing attached to heel-operated levers in the cockpit. Front and rear cockpit levers are interconnected with tube.
in windshields are standard equip-
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front cockpit, with extension rod to the rear cockpit. Throttle controls are in both cockpits.

Wing panel structures are made of spruce spars, round chrome molybdenum steel tube compression struts, high carbon steel tie rods and stamped chrome molybdenum steel fittings. Ribs, leading and trailing edges, center section cutout, walkboards, etc., are sheet duralumin stampings. Covering is of fabric, independently attached to upper and lower cap strips of ribs by a screw and washer arrangement.

Interplane bracing comprises streamlined chrome molybdenum steel tubing external struts, and streamlined tie rods. Both rear outer struts and the left center section diagonal strut are adjustable for rigging.

Ailerons, on the lower wings only, are balanced by hinging aft of their leading edge. They are triangulated spruce and plywood structures, fabric covered, and incorporate a design and rigging feature of a variable-camber device for evenly balancing air loads. The ailerons are operated by a mechanism comprising an operating lever attached to the aileron through a special bracket and operating tubes connecting the levers to the control stick. This mechanism produces no holes in upper or lower wing surfaces nor any excrescences, and eliminates cables and bellcranks.

A special wing cellule with a 4-ft. greater span than standard, has been developed and is available on special order
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direction of engine rotation, to partially counteract engine torque.

The landing gear, of the cabane-divided axle type, is made up of alloy-steel tubular members, the axles and oleo cylinders being heat-treated. Shock absorbers are of long stroke oleo type with long stroke steel coil taxiing springs. Axles are finished to take 6.50 × 10 roller bearing wheels (with or without brakes), and 8.50 × 10 tires.

The tail skid is a four-leaf cantilever spring fitted with an alloy steel skid shoe.

The Kinner engines are interchangeably mounted through drop forged self-aligning clamps, and other radial engines may be similarly installed. In-line engines are suspended on conventional bearers. Exhaust collector manifolds are optional equipment.

Wood propellers are standard equipment for all except the Kinner R-5 160 h.p. engine. Either Curtiss or Hamilton-Standard metal propellers (optional equipment on K-5 and B-5 engines), may be used on all engines.

The fuel system is gravity fed from a 24-gallon lead-coated steel tank (27-gallon, optional equipment) in the upper wing center section. This tank has two outlets, right rear and left front, insuring drainage in all positions of the airplane.

A 25-gallon belly tank is available as optional equipment, and is located under the fuselage. The hand operated pump which delivers gasoline from this tank to the wing tank is provided with dual control to permit operation from either cockpit.

A 35-gallon tank may be installed in the front cockpit, making the airplane a single seater.

A steel oil tank holding 3 gallons of oil and with one gallon expansion space, is mounted ahead of the firewall.

Specifications of the basic model of the Fleet biplane are as follows:

Wing span	28 feet
Wing chord	45 inches
Wing area	194.4 square feet
Stabilizer	15.72 square feet
Elevator	10.78 square feet
Fin	2.9 square feet
Rudder	8.16 square feet
Aileron	21.74 square feet
Length overall	21 feet 8 inches
Height overall	7 feet 10 inches
Wheel tread	76.75 inches

Performances of the Model 10 and Model 11 are as follows:

	Model 10	Model 11
Maximum speed	115	125 m.p.h.
Cruising speed	96	109 m.p.h.
Landing speed	47	48 m.p.h.
Service ceiling	14,300	17,800 ft.
Rate of climb	862	1178 ft. per min.
Cruising range	627	553 miles

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Propulsion By Reaction

Experimental Research on the Transformation of Energy of a Gas Flowing through a Tube (Richerche sperimentali sulle trasformazioni di energie di un gas scorrente in un tubo), A. Castagna. Laboratorio di Aeronautica della R. Scuola di Ingegneria (Reprinted from publication of the Reale Accademia delle Scienze di Torino) Report No. 72, 1935, *pp.* 285-317, 6 *figs.*

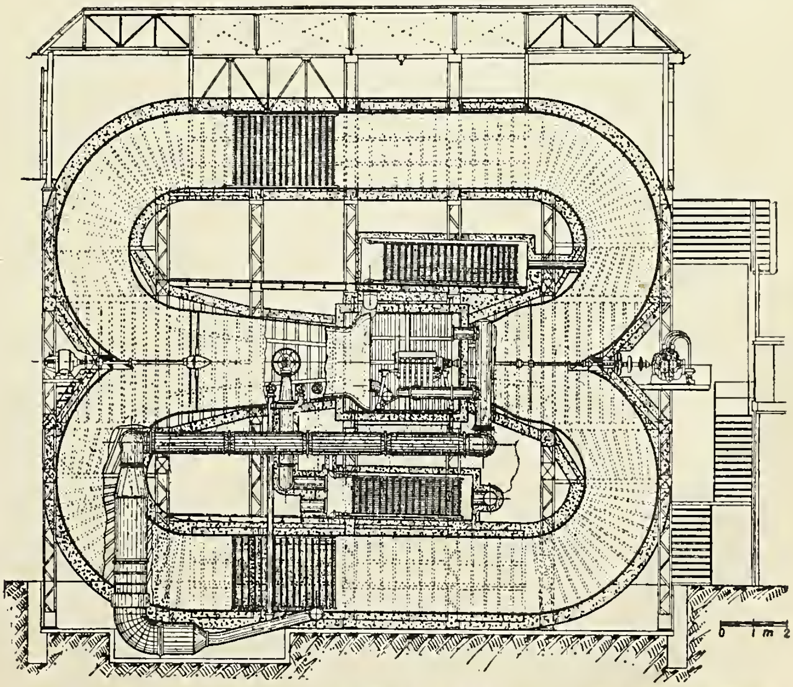
THE PROBLEM of fluid compression by inertia at velocities higher than sound, which is fundamental in propulsion by reaction, is studied and the properties of the motion of the fluid within a tube and the tube dimensions are found. In the Laval tube used in the experiments the air was expanded to obtain the highest possible velocity, with successive tubes with sections increasing in the direction of the motion. The ratios between the extreme pressures was between 3 and 350 for expansion and from 2 to 13 for compression by inertia. The expansion in the Laval tube was developed with little loss, even for the highest ratios, and the adiabatic efficiency was found to be around 90%, although this decreased considerably when the Reynolds Number was less than 3.10^5.

Report No. 66 of the Laboratorio gives the formulas for the experimental study of the transformation of energy of a gas flowing through a tube.

Engine Altitude Tests

Relation between Tests Carried out on the Asso 750 *Engine in the High-Altitude Plant and those under Normal Conditions for the Determination of New Formulas for the Correction of Power to Standard Air (Relazione sulle prove eseguite nell'impianto alta quota della I.F. col motore "Asso* 750" *normale, per la determinazione delle nuove formula di correzione della potenza in aria tipo) L'Aerotecnica, Vol.* 13, *No.* 5, *May,* 1935, *pp.* 457-482, 6 *figs.,* 14 *curves.*

RESULTS OF numerous tests are described which were carried out by the General Construction and Materiel Division of the Italian Air Ministry to determine more accurate formulas for correcting airplane-engine power to that in standard air. Results obtained with the Asso 750 normally and in the F.I.A.T. high-altitude test chamber are compared. Power curves are given in function of the inlet temperatures and pressures as well as of exhaust back pressures. The correction coefficients are compared with those used in America and new formulas are developed for the reduction of power with altitude, and for the corrections of the back-pressure, and the depression to the exhaust.



Cross-sectional view of an altitude test chamber built by Isotta-Fraschini for aircraft engines

Seaplane Take-Off

Cine-Photographic Measurements of Speed and Attitude of Southampton Aircraft when Taking Off and Alighting, A. E. W. Nutt and G. J. Richards. (British) Aeronautical Research Committee—Reports and Memoranda No. 1621, *September,* 1934 (*Published April* 26, 1935), 13 *pp.,* 8 *figs.*

THE POSSIBILITY of taking cinephotographs of the take-offs and landings of seaplanes with a time record arranged simultaneously on the film was investigated and the speeds were measured by an analysis of the records obtained. A probable error in speed of approximately +1.4 knots was indicated. It was found that the lift coefficients for the Southampton plane at the instant of take-off and alighting, over a wide range of incidence, were considerably higher than those for similar aircraft in free flight at an altitude.

Aerodynamics

Disturbances Caused in the Motion of a Fluid by the Variations in Temperature (Perturbations provoquées dans le mouvement d'un fluide par des variations de la température), C. Woronetz. Publications Scientifiques et Techniques du Ministère de l'Air, No. 60, 1934 (*Published January* 30, 1935), 49 *pp.,* 9 *figs. Bibliography.*

A THEORETICAL study is reported for the disturbances in a fluid mass in motion which are created by variations in temperature. A simplification of the method of J. Boussinesq is developed for the equations of motion while the stability of a gyratory motion of fluids between two coaxial cylinders maintained at different constant temperatures is taken up. The functions of Bessel are applied and the gyratory motion of a fluid between two concentric spheres of different constant temperatures is determined.

Fatigue of Carbon Steel

Research on the Resistance of Carbon Steels to Fatigue (Recherches sur la résistance á la fatigue des aciers au carbone), M. Ogée. Publications Scientifiques et Technique du Ministère de l'Air, No. 58, 1934 (*Published January* 30, 1935), 69 *pp.,* 36 *figs.,* 16 *microphotographs on supplementary plates.*

THE RESEARCH analyzed in the report was undertaken to distinguish the coefficients of action on the resistance to fatigue for the various components simultaneously present in carbon steel. Eleven different steels varying from 0.27 to 0.65 per cent carbon were studied and the relation between the fatigue strength and the physico-chemical constitution of the steels determined.

In describing his experiments, the author shows the new form of test piece adopted to eliminate all curves in the region of rupture and explains the design of two rotary bending machines, operating between 1,800 and 3,000 r.p.m., namely the Alkan and a second machine for testing six pieces at a time. He points out the effect of chemical composition and heat treatment on fatigue strength, the relation between this resistance and other mechanical properties, and explains the mechanism of ruptures due to fatigue.

Aerodynamics

On the Effect of Discs on the Air Forces on a Rotating Cylinder, A. Thom. (British) Aeronautical Research Committee—Reports and Memoranda No. 1623, *January* 5, 1934 (*Published April* 26, 1935), 10 *pp.,* 14 *figs.*

IN THE experiments described the rotors were built up from thin circular aluminum disks mounted on a steel spindle between short lengths of cylinder, two sizes of disks and cylinders being used. Experiments were also made with end disks and both sanded and plain cylinders. It was found that, at the lower values for the ratio of circulation velocity at the surface to the undisturbed velocity, the lift and drag coefficients were almost identical with those obtained for the plain cylinder, while at higher values of the ratio, the lift coefficient became very large and the drag became small and then rose suddenly.

Photographic Emulsions

Study of the Chromatic Sensitization and Desensitization of the Photographic Emulsions (Étude de la sensibilisation chromatique et de la désensibilisation des émulsions photographiques), A. Charriou. Publications Scientifiques et Technique du Ministère de l'Air, No. 61 1935, 229 *pp.,* 73 *figs. Bibliography.*

PROPERTIES AND methods of preparing all the coloring sensitizers known at present are reviewed and the phenomena of desensitization, as well as the characteristics of desensitizers, are taken up. The preparation of orthochromatic emulsions, chromatic sensitization by inorganic bodies, and sensitization of photographic emulsions to the ultra violet are discussed.

Transport Planes

Commercial Aircraft, G. De Havilland. Royal Aeronautical Society—Preprint for Meeting April 15, 1935, 14 *pp.,* 8 *figs.*

QUESTIONS OF speed and load of transport planes are discussed from a designer's viewpoint. The author takes up the effect of increasing design speed and points out the overwhelming influence of the variable-pitch propeller on the possibility of making fast and economical airplanes. He refers to the *Comet* as a scale model for a transport plane and discusses take-off and landing regulations. He emphasizes the importance of passenger comfort and believes that for planes of moderate size wood is safe, light and reliable as the time has not arrived when the use of metal is warranted. He concludes with a review of the evolution of transport planes in the last decade.

WRIGHT WHIRLWINDS

(*Continued from page* 49)

tion houses the accessory drives and supports the engine accessories. Mounting lugs by which the engine is attached to the mounting ring of the airplane are also carried by this section.

Bearings are of ample size and of either a plain or anti-friction type. Connecting rods are of forged nickel steel, and consist of a one-piece master rod and articulated rods, all of "I" section. The crank pin bearing is of a special anti-friction metal alloy, steel backed, shrunk and dowelled into the master rod big end. Piston-pin and knuckle-pin bushings are of bronze.

Tulip shaped valves are used. The hollow stem exhaust valve is of special non-burning steel; the solid stem intake valve is of alloy steel. In highly supercharged models sodium-filled exhaust valves are used as a cooling aid. Valve springs (three to each valve) are helical, made from heat-treated spring steel wire, and are concentrically fitted.

Each engine is provided with a built-in centrifugal type supercharger driven at from 7 to 10 times crankshaft speed. Higher gear ratios are used in certain models to increase power output at sea level, without additional weight, to offset normal power losses at altitude, or provide higher power outputs at high altitudes.

A stainless steel front collector ring type exhaust manifold which scavenges the exhaust gases without back pressure, is furnished as standard equipment. This manifold is provided with a single outlet elbow which may be led back in convenient positions. Rear exhaust elbows for cylinder exhaust ports may be furnished where it is desired to use a rear exhaust system or short open stacks.

Cowl and manifold support consists of a formed aluminum plate fitted between the exhaust manifold and the crankcase front section. It is rigidly supported with rivetted plates at the fastening points and provided with cowl fasteners at its outer circumference. The front of the cowl is open and no shutters are used. An opening at the lower part of the cowl connects with the carburetor air preheater and cleaner.

BELLANCA 1935 SERIES EIGHT PACEMAKER

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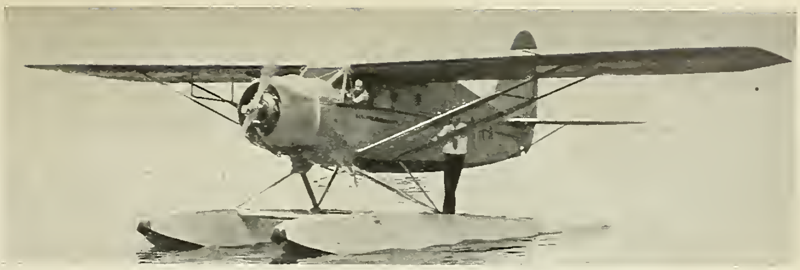


● Bellanca Aircraft Corp. has recently produced and delivered a new aircraft powered with the Wright Whirlwind R-975-E2, 420 h.p. engine and equipped with a Hamilton Standard controllable pitch propeller. Known as the 1935 Pacemaker Series Eight, this monoplane has been tested and has received Department of Commerce approval as an eight-place landplane and as an eight-place seaplane.

The first of the Series Eight Pacemakers has been delivered to General Airways, Ltd., of Toronto, Ont., the fifth Pacemaker put into service by this company for its operations throughout Canada.

The efficiency of this plane is attested by the fact that as a cargo landplane it has a payload of one ton with 400 to 500 miles range; in addition it shows a top speed of 170 m.p.h.

As a passenger-carrying commercial landplane or seaplane it is licensed for eight-places and in addition is available in a six-place version for executive use.

New features incorporated in the 1935 Pacemaker Series Eight include a wide, roomy cabin 4 inches wider than previous Pacemakers; full NACA cowl; and throw-over wheel control.

The fuselage is of welded chrome molybdenum steel tubing, fabric covered, into which is built the cabin, which measures at its maximum dimensions 113" × 46" × 56". Non-shatterable glass is fitted in all windows, and the seats are upholstered and equipped with sponge rubber cushions. Behind the rear seat is a 13 cubic foot baggage compartment, accessible from inside or outside the cabin, and large enough to accommodate 24 lbs. of baggage. The freighter substitutes removable folding benches on the sides of the cabin for the chairs used in the transport, but retains the double seat in the rear. Pilots' seats are adjustable fore and aft and a throw-over wheel control is provided, as are dual pedals. Instruments provided as standard equipment include a tachometer, oil pressure gauge, altimeter, compass, airspeed indicator, rate of climb indicator, turn and bank indicator, clock, and fuel gauge. The instrument panel of the transport is mounted on rubber and is indirectly lighted.

Wings are of wood construction, fabric covered, with solid spruce spars; lift struts are all-metal, also fabric covered. Flaps are not standard equipment but can be furnished if desired.

Fin, rudder and elevators are fabric covered welded steel tubing, and the stabilizer is wood construction, fabric covered. The stabilizer is adjustable in flight by hand wheel control accessible from either seat. The fin is adjustable on the ground, and ailerons are slot-balanced. Cables run over ball bearings, and all control bearings are Alemite equipped.

The landing gear which has a tread of 96⅝", is of the cantilever type built up of chrome molybdenum steel tubing and equipped with oleo shock absorbers, 9.50 × 12 wheels and semi-air tires. The tail wheel is fully swivelling through 360°, and is provided with a 4 × 5 balloon tire.

The fuel supply system of the freighter is gravity feed from two 100-gallon wing tanks, 64 of which are used with a cargo of 2000 lbs., and 187 of which are used when 8 passengers are carried. A 12.5-gallon oil tank is under the wing cowl with the temperature control operated from the pilots' cockpit.

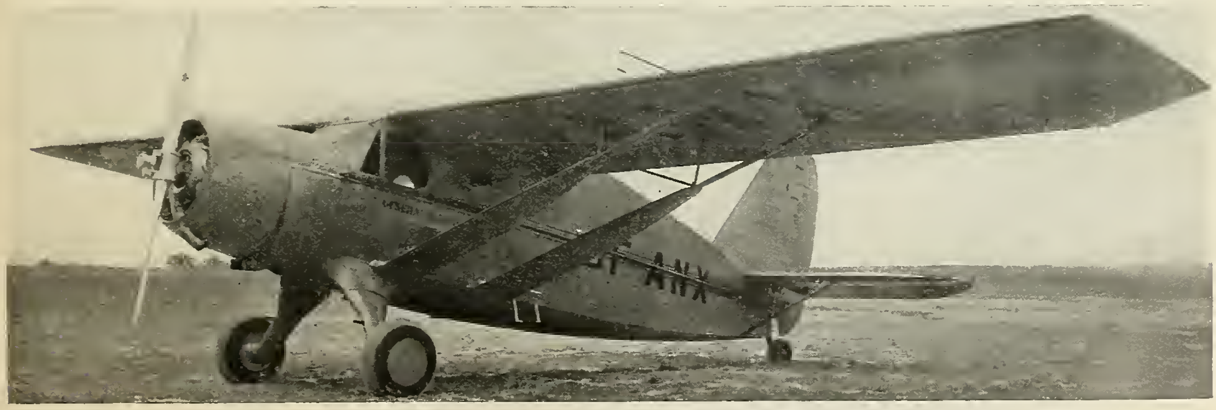
The freighter has an empty weight of 2950 lbs., and carries a useful load of 2650 lbs.; the 8-place transport weighs, empty, 2900 lbs., carrying a useful load of 2600 lbs. The executive model for six persons has an empty weight of 3250 lbs., and a useful load of 2350 lbs. All have a gross weight of 5600 lbs.

As a seaplane, the plane carries a pair of standard Edo model 6235 floats with water rudders, and has been licensed by the Department for a gross weight of 5900 lbs., with an empty weight of 3471 lbs.

Cruising range differs in that the freighter specifies 400 miles, the 8-place transport 1180 miles, and the executive model, 860-1100 miles.

Specifications and performances of all three are otherwise identical as follows:

Overall length	27 feet 11 inches
Overall height	8 feet 6 inches
Wing span	50 feet 6 inches
Wing area	311 square feet
Fuel capacity	200 gallons
Oil capacity	12.5 gallons
Maximum speed	170 miles per hour
Cruising speed (75% power)	145 m.p.h.



Bellanca Series Eight Pacemaker as a land plane, used for freight carrying in Canada

NEW EQUIPMENT and METHODS

Eleven-Pound Transmitter

• A COMPACT radio transmitter, known as the 19A Midget Transmitter, intended primarily for the small privately-owned airplane and suitable also for harbor craft has been designed by Bell Telephone Laboratories for Western Electric Co. Complete with shock-proof mounting, it weighs about 11 lbs. and measures 8.5" × 9.5" × 6.5".

The transmitter operates over the frequency range between 2 and 7 megacycles and offers transmission by voice, tone telegraphy (with complete modulation and an output of 5 watts), and a 15-watt output continuous wave telegraphy. Filament power is obtained from a 12-volt battery, high voltage for the tube plates being supplied by a 550-volt dynamotor operated from the same battery.

Any two frequencies within the band may be obtained by inserting the proper crystal and adjusting the single tuning control. A twin crystal unit is available to enable the pilot to transmit on either 3105 or 3120 kc. (frequencies for calling and working with any Department of Commerce station along the commercial airlines or with any airport equipped for such service). To shift from one to the other, the pilot flips a switch on the front of the transmitter, and no tuning adjustment is necessary because of the small difference in frequency.

Two similar vacuum tubes are used, both being of a recently developed power pentode tube. The first acts as the crystal controlled oscillator; the second as either an amplifier, a modulating amplifier or a modulating amplifier and voice frequency oscillator, depending on the type of transmission being employed.

Used in conjunction with the new two-band, 11-lb. double duty receiver, this transmitter provides two-way communication with apparatus of the same standard as that used on the airlines. The weight of the complete transmitter and receiver installed, with dynamotor power supply, is about 46 lbs.

Installation of the Western Electric midget receiver and transmitter

High-Speed Grinder

• NEW DESIGN, materials and principles have been utilized in the production by the Chicago Wheel & Manufacturing Co., Chicago, of a new high-speed electric tool, the DeLuxe Hand-ee Grinder.

Through the use of new materials, weight has been reduced to fifteen ounces though the tool has a speed of 25,000 r.p.m. and ample power to drive a variety of different accessories. Aluminated duralumin is employed in the body of the tool while moulded bakelite parts are used as bearing retainers and for end caps. The grinder is 6" long overall and 1⅝" in diameter. Housing is streamlined through the use of a new radial commutator and S-type built-in switch with sliding contacts. Heat has been eliminated due to the radically new type fan mounting.

Tilting test stand for Bristol engines

Tilted Engine Test Stand

• THERE HAS recently been included in the line of test hangars at the Bristol Company's engine department at Bristol, England, one of special design which allows the engine on test to be tilted either up or down to simulate climbing or diving conditions. This stand is a rigid structure incorporating a mounting which holds the engine and which is capable of being revolved through a complete arc of 180°.

All controls and feed lines, with the exception of the feed lines of the lubricating system which is actually mounted on the trunnion arm and moves with the engine, are flexible in order that the movement of the engine shall be as unrestricted as possible. The controls are actuated by means of Arens cables, such as those described in the March, 1935, issue of Aero Digest.

The additional facilities offered by this new stand permit engines to be examined for all conditions of flight, and particularly those which are engendered during terminal velocity dives.

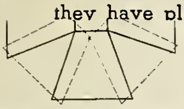
Turret Lathe

• A NO. 4 Universal turret lathe of a new size, embodying a number of improvements, has recently been produced by the Warner & Swasey Co., Cleveland, to utilize to advantage cemented tungsten carbide, in addition to high-speed steel cutting tools. It has 12 spindle speeds which range from 30 to 751 r.p.m. and a 7½ h.p. motor may be used. Provision is also made for the application of a two-speed motor, giving an additional 12 speeds.

Anti-friction bearings are used throughout the head of the machine with the spindle's front bearings mounted on double roller bearings. Head gears are of chrome nickel alloy steel, hardened and ground.

VERSATILITY

Vought Corsairs operate with equal facility from land, water, carrier deck, or catapult. For more than 15 years they have played an ever-increasing



Setting of combining parts and method of assembling prints of the Fairchild ten-lens compound aerial camera

Ten-Lens Camera

• THE NEW compound aerial camera devised by Fairchild Aerial Surveys includes two Fairchild five-lens camera units installed in a special mount with articulated shutter control. One camera is set at an angle of 45° to the other so that the ten prints secured with each tripping of the master shutter control overlap to make an octagonal composite print covering 750 sq. mi. of ground area at 30,000 ft.

The accuracy of the camera depends to a large extent upon the aluminum alloy mount, specially seasoned and heat treated to maintain precision under all operating conditions. The mount has been machined with the same accuracy characteristic of the other elements of the camera. Special adjustments in its setting are made by large tangent screws. The mount alone weighs only 85 pounds; the complete units assembled without film rolls weighs 275 pounds.

The ten rolls of film needed for a single loading weigh 70 pounds and include 1200 feet of film, sufficient for 2000 individual photographs, or 200 composite photographs of 10 exposures each. Each set of 10 prints secured with each tripping of the shutters of the camera measures 32" square.

The ten shutters are operated electrically at the same instant by operation of a single release which is contained in a "surge box" independent of the compound camera. Efficiency is assured by the flashing of a small neon light should any of the ten shutters fail to function.

The accompanying diagram shows the setting of the combining parts of the camera, and the method of assembling prints to make the octagonal composite. The camera units are set at an angle of 45° to each other in order to photograph the entire area. Fairchild Aerial Surveys is to use one of these units in filling a contract recently placed by the Soil Conservation Service of the Department of Agriculture for a photographic survey of New Mexico.

developed a single point precision boring machine which reduces the present operations required for finishing. Rough boring and semi-finish boring will be the same as required at present, but the single point precision boring will replace the reaming and rough honing operation.

These machines are full hydraulic and are operated by one man. To operate, the control handle is moved to the loading position and two cylinder blocks are drawn into the fixture from the loading station by a hydraulically operated pull bar which also unloads the fixture after the boring operation. The control handle is then moved to the starting position which raises the locating pins that engage dowel holes in the bottom of the block, the clamping cylinders in the top of the fixture lock each block securely in place and the machine starts through its automatic cycle. The slide carrying four boring units move in rapid traverse until the boring spindles reach boring position. Due to the close center distance of the bores, the boring units are so arranged as to bore alternate holes in both blocks at each operation.

Control dogs on each slide advance the boring units into feed position to bore the cylinders. At the end of the boring stroke another dog on the slide actuates a limit switch which in turn operates the mechanism for stopping each boring spindle with the boring tool in the proper position. The fixture then shifts .008" to .100" moving the bore away from each tool so that they can be withdrawn without contacting the finished surface as the slides return to the starting position.

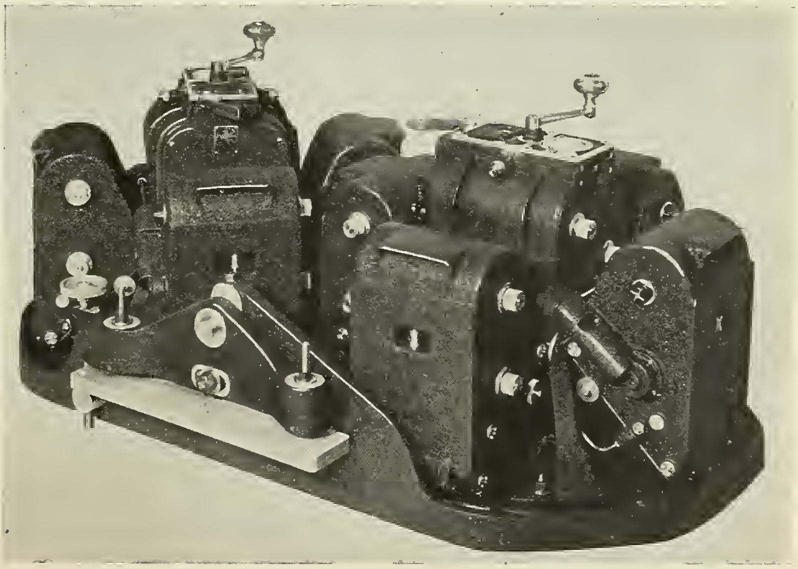
After the slides stop in the starting position the fixture automatically indexes horizontally the desired distance between holes in the block for boring the next pair of holes. The next boring cycle is automatically repeated.

Solidified Fuel Operates Engine

• TESTS ON a new-type of non-explosive fuel are being conducted at the Daniel Guggenheim School of Aeronautics under the direction of Dr. Alexander Klemin.

The result of the experiment by Dr. Adolph Prussin, the fuel is a jelly-like solid that is claimed to be an economical factor in the operation of an engine, and adaptable for aircraft use where it could influence the safety factor of flight.

The substance at present is enclosed in a jacket heated from the exhaust of the engine which is started by ordinary fuel. It is made by means of a catalyst which is then withdrawn and reused. In demonstrations at the school, the fuel did not explode when fired upon with incendiary bullets, and it operated a single-cylinder test engine which produced 2.26 h.p. at 1085 r.p.m., at a fuel consumption of .71 lbs./h.p./hr. With ordinary fuel the same engine produced 2.41 h.p. at 1125 r.p.m. at a fuel consumption of .92 lb./h.p./hr.



The newly-developed Fairchild compound 10-lens camera for aerial photography

PMENT and METHODS

ntrolled oscillator; the second as either
amplifier, a modulating amplifier or a
odulating amplifier and voice frequency
cillator, depending on the type of trans-
ission being employed.
Used in conjunction with the new two-
nd, 11-lb. double duty receiver, this
ansmitter provides two-way communi-
tion with apparatus of the same stand-

THE AIR SERVICES

Contracts Let for More Planes

WAR AND NAVY Department awards recently delivered call for the expenditure of $8,750,615 for service craft, their propelling plants and equipment.

One contract was awarded to the Consolidated Aircraft Corp., for 60 flying boat patrol planes of the P3Y type at a price of $90,000 each ($5,400,000). When the cost of 20 percent spare parts, of drawings, tests, etc., is added, it makes up a total contract price of $6,506,000.

These flying boats will be about the same gross weight as the P2Y type which made the mass formation flight from San Francisco to Pearl Harbor in January 1934. They will have greater speed, greater range, as well as many other improved characteristics of performance.

Contracts for the engines of these planes were awarded to the Pratt & Whitney Aircraft Division of United Aircraft Mfg. Corp., for 150 radial air-cooled Twin-Wasp engines which together with 25 percent engine spare parts comes to $1,764,787, and to the Hamilton Standard Propeller Division of the same company for 150 controllable-pitch propellers. With spare parts, this contract amounts to $236,250.

The War Department announced the award for 26 Primary Training airplanes to the Stearman Aircraft Co., in the total amount of $243,578.

In accordance with normal procedure, the airplane on which the bid was received was evaluated by actual flight tests conducted by a Board of Officers. In view of the fact that it represented a marked advance in Primary Training type development, the contract was awarded for these airplanes. The total amount also includes a limited number of spare parts.

New Bomber Tested

THE WAR Department recently issued the following announcement relative to new-type bomber. Hailed as the fastest and longest range bomber ever built, a four-engined all-metal airplane was developed by the Boeing Aircraft Company of Seattle.

Known as the Boeing 299, the craft is now undergoing test flights before being submitted to the Air Corps in open competition with other types at Dayton, Ohio. While military secrecy necessarily shrouds many details of the Model 299, Boeing officials said, however, that it would meet or exceed specifications of the Air Corps.

Among other things, these requirements call for a high speed of from 200 to 250 m.p.h. at 10,000 ft., for an operating speed of from 170 to 220 m.p.h., at the same altitude, for an endurance at operating speed of from six to ten hours, and for a service ceiling of from 20,000 to 25,000 ft.

Acme Photo

The new all-metal Boeing bomber powered by four Pratt and Whitney Hornet engines.

The Boeing has a wing span of approximately 100 feet, length of 70 feet, height of 15 feet, and gross weight of about 15 tons. It is of the all-metal mid-wing type, equipped with four P. & W. Hornet engines with Hamilton Standard three-bladed constant speed propellers. Clean streamlining is featured including a retractable landing gear and tail wheel.

A number of new armament installations are carried in addition to the latest types of flight and engine instruments, including an automatic pilot, two-way radio telephone equipment and a radio homing device.

Construction is typical Boeing semi-monocoque type, the structure consisting of longerons, skin stiffeners, bulkheads and smooth outside metal skin.

Guardsmen Provide Aerial Show

THE THIRTY-FIFTH Division Aviation, Missouri National Guard, led by Maj. Phil Love, presented a flight program before approximately 20,000 persons at Lambert-St. Louis Municipal Airport last month.

The show opened with tactical maneuvers, including a V-formation flight and a Luffberry circle; Corp. Robert W. Rush, and Sergt. William Brazil made parachute jumps and a sham target practice was directed from a National Guard plane by Lieut. Roy Alexander.

The evening schedule included formation flights in which a display of aerial fireworks was given, the event being featured by Lieut. Ray Cutter's aerobatics.

Hegenberger Wins Collier Trophy

THE COLLIER Trophy for 1934 was awarded to Capt. Albert F. Hegenberger of the U. S. Army Air Corps, for his blind landing achievements. This trophy is awarded annually to a member of the U. S. Army Air Corps for outstanding contributions to aeronautical science.

Capt. Hegenberger developed the blind landing and blind flying system now going into practical use.

Improvements at Pope Field, Ft. Bragg

WITHIN THE last nine months, many improvements have been made at Pope Field, Fort Bragg, N. C., under the direction of Capt. E. P. Gaines, commanding officer.

A few of the more important improvements include an 800 ft. drainage system, an engineering office and a waiting room for pilots; the planting of 131 trees and a 5-acre garden for the organization mess; clearing and leveling of an extension to the airship field which increases its size to 2,000 × 1,000 feet.

It is understood a 24-hour teletype weather station will soon be in service at the field, completing the New York-Miami chain. The Department of Commerce will install the teletype system, and the Balloon Squadron and Flight "C" men will maintain it.

Barnaby Cited for Glider Work

SECRETARY OF the Navy Swanson has awarded a letter of commendation to Lt. Commander Ralph S. Barnaby, (CC) on his successful experimentations in the field of gliding and soaring during the past twenty-six years. Lt. Commander Barnaby is now in charge of glider training at the Naval Air Station, Pensacola, Fla., and holds No. 1 soaring license in the United States. He was the first to make a glider descent from an airship, the U.S.S. *Los Angeles.*

Runway Funds Sought

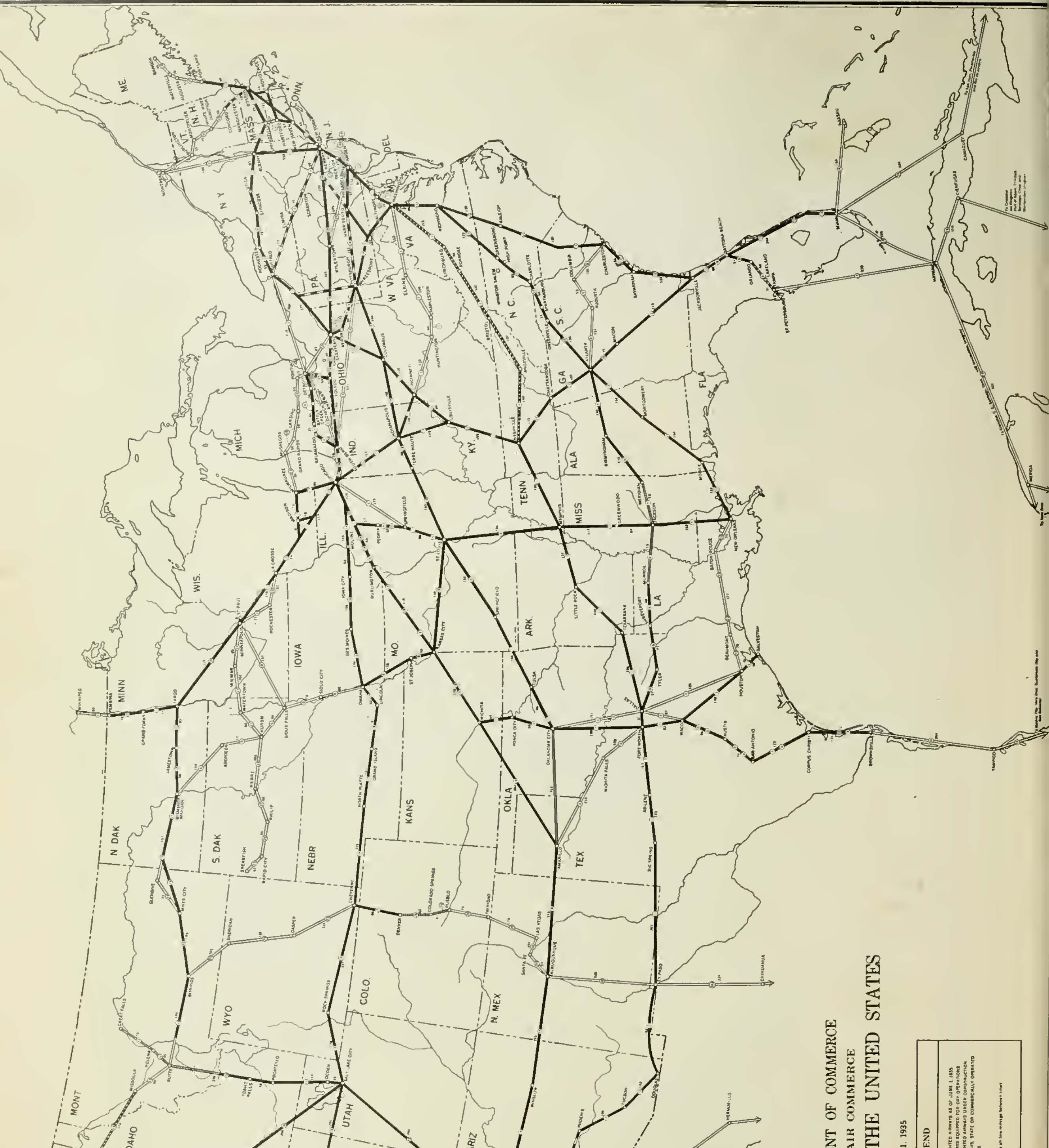
AN APPLICATION for funds amounting to $153,000 under the new Federal works program with which to construct two additional runways at Hensley Field, army reserve airport in Dallas, has been made. Data and other requirements are being formulated and it is hoped that, with this money, this field will rank with the finest in the country. Hensley Field is under the command of Capt. Bernard S. Thompson, and now has two crushed rock runways built a year ago by CWA labor. A total of ninety reserve flying officers from Texas, Oklahoma, Colorado, New Mexico and Arizona have taken training in active duty work this summer there. Five classes, each consisting of two weeks service, have been completed.

VERSATILITY

Vought Corsairs operate with equal facility from land, water, carrier deck, or catapult. For more than 15 years they have played an ever-increasing part in the observation, bombing, and scouting aircraft activities of the U. S. Navy and U. S. Marines.

CHANCE VOUGHT AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford **Connecticut**
E. E. Wilson, General Mgr. C. J. McCarthy, Engineering Mgr.

"Official Photograph U. S. Navy"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ME.
LEGEND
FEDERALLY LIGHTED AIRWAYS AS OF JUNE 1, 1935
FEDERAL AIRWAYS EQUIPPED FOR DAY OPERATIONS
FEDERALLY LIGHTED AIRWAYS UNDER CONSTRUCTION
LIGHTED AIRWAYS, STATE OR COMMERCIALLY OPERATED
OTHER AIRWAYS
Numbers in circles indicate air line mileage between cities

U. S. DEPARTMENT OF COMMERCE
BUREAU OF AIR COMMERCE

AIRWAY MAP OF THE UNITED STATES

June 1, 1935

AIRLINES AND AIR TRAVEL

Transport Activities Increasing

CURTAILED ACTIVITIES of the transport system as a result of the air mail cancellation are evidenced in May, 1935 reports which show 72,267 passengers carried, compared with 41,847 in 1934 and 45,061 for May, 1933.

Passenger miles flown in May, 1935 were 30,455,455, and pounds of mail and express carried were 1,127,725 and 407,230 respectively. May was the best month thus far this year, exceeding previous months by good margins in practically every category, including performance with 93.6% efficiency. During the month, 5,347,312 miles were scheduled, and 5,066,224 flown; 2,692,426 gallons of fuel and 76,999 gallons of oil were consumed.

For the first five months of the year 285,798 passengers were carried, 1,623,882 pounds of express and 4,960,995 pounds of mail transported, and 11,612,832 gallons of fuel used. Of the 23,610,027 miles scheduled, 21,380,467 miles were flown, with an efficiency record of 89.1%.

Increasing traffic trends are reflected in reports of the individual airline companies. Transporting 17,297 revenue passengers in 30 days, American Airlines established an all-time record during June, C. R. Smith, president of the company, announced. In each of the last five months, American Airlines' passenger traffic has shown an increase over the preceding month ranging from 1,100 to more than 5,000 passengers. April, May and June have been, successively, the biggest months in the company's history.

During June, passengers carried over Pennsylvania Airlines' system between Washington, Detroit and Milwaukee totaled 4881, as compared to June of 1934 when 1716 passengers were transported, an increase of 185%. Figures for the first six months of 1935 show that this increase has been constant throughout the period mentioned. Between January and June of the current year, Pennsylvania Airlines sold 19,359 passenger tickets, as compared to 6303 for the same period in 1934, an increase of 205%.

Air mail dispatched in May at the St. Louis Post Office amounted to 8260 pounds as compared to 3521 pounds for the same month of last year, an increase of 134.6 per cent. Air mail received in St. Louis in May amounted to 8277 pounds as compared to 2719 pounds during May, 1934, or an increase of 204%.

Planes of the United Air Lines flying the Seattle-San Diego route scored a 100% efficiency record during June on both daylight and overnight flights with every mile of the 293,977 scheduled mileage flown, according to R. F. Ahrens, district traffic manager.

Personnel Notes

SEEKING TO bring its study of weather conditions to a new peak of accuracy, American Airlines engaged one of the country's foremost meteorologists and ten of his associates to give it the benefit of the latest scientific discoveries concerning the weather. He is Dr. Irving P. Krick, Assistant Professor of Meteorology at the Daniel Guggenheim School of Aeronautics, California Institute of Technology. His assistants are Dr. G. F. Taylor, W. C. Rockefeller, K. A. Willard, Don Ricketts, Benjamin Holzman, A. C. Reed, H. C. Portman, and Salvatore Pagliuca. All will work with Earl Ward and Hugh Smith, general superintendents, and with flight superintendents, meteorologists, dispatchers and pilots of American Airlines. The company also announced the appointment of Melvin D. Miller as assistant to President C. R. Smith, in charge of sales. Miller is former sales manager of the Remington-Rand Corp.

Harold White, former station manager of Braniff Airways at Fort Worth has been appointed mail-express manager with headquarters in Dallas. His position at Fort Worth was taken by Peter Lenszler who was transferred from Kansas City. Other personnel changes in the company include the appointment of Helen R. Johnson as special representative in charge of activities pertaining to feminine interests in air transportation over the line, and Stuart Bailey as assistant to President T. E. Braniff with offices in Oklahoma City.

H. L. Beynon has been made manager at Jackson, Miss., by Chicago and Southern Air Lines, and H. C. Duncan, former manager of the consolidated ticket office at the Oklahoma City municipal airport, was appointed city traffic agent for American Airlines at Tulsa.

The appointment of R. S. Knowlson, former aviation editor of the Kansas City *Star*, as publicity representative of TWA at Kansas City was announced by Jack Frye, president.

Eddie Rickenbacker spoke on "Air Transportation and World Peace" at a Sales Club luncheon in New York City, and D. W. Tomlinson predicted "Airliners of the Future." Others on the program were Jimmie Doolittle, Frank Hawks, Clyde Pangborn and Al Williams.

New Low Fares Offered

RAIL PLUS Pullman schedule of fares recently put into effect by Chicago and Southern Air Lines represent reductions ranging from 25 to 35 per cent over former fares.

The new fare between Chicago and St. Louis is $9.67 as compared to the former charge of $13.95; St. Louis to New Orleans $26.39 as against the old fare of $34.20. An additional 10 per cent reduction is offered on a round trip ticket.

SCHEDULED AIRWAY OPERATORS

(M = mail P = passengers E = express)

Route No.	Operator	Routes Operated	Route Mileage	Class of Service
①	American Airlines, Inc	New York to Ft. Worth (via Washington & Nashville)	1466	MPE
		Fort Worth to Los Angeles	1293	MPE
		New York to Chicago (via Buffalo & Detroit)	754	MPE
		Detroit to Chicago (via Kalamazoo)	263	MPE
		Chicago to St. Louis	257	MPE
		Chicago to Fort Worth (via Peoria St. Louis, Tulsa & Okla. City)	950	MPE
		New York to Boston (via Springfield, Mass.)	206	MPE
		New York to Boston (via Hartford & New Haven)	209	MPE
		Boston to Cleveland (via Albany & Buffalo)	637	MPE
		Cleveland to Nashville (via Columbus & Louisville)	459	MPE
		Washington to Chicago (via Cincinnati & Indianapolis)	684	MPE
		New York to Montreal	332	MPE
②	Bowen Air Lines, Inc	Fort Worth-Dallas to Brownsville	551	PE
		Fort Worth-Dallas to Houston	255	PE
③	Braniff Airways, Inc	Chicago to Kansas City	410	MPE
		Chicago to Dallas (via Kansas City, Wichita & Oklahoma City)	964	ME
		Amarillo to Fort Worth	315	MPE
		Dallas to Brownsville	546	MPE
		Waco to Galveston	206	MPE
④	Central Airlines, Inc.	Washington to Detroit	469	MPE
⑤	Chicago&Southern Air Lines Inc.	Chicago to New Orleans (via Peoria)	872	MPE
⑥	Delta Air Corporation	Charleston, S. C. to Dallas	1065	MPE
⑦	Gorst Air Transport, Inc.	Seattle to Bremerton	15	PE
⑧	Hanford Tri-State Air Lines, Inc.	St.Paul to Omaha (via Sioux Falls)	369	MPE
		Omaha to Kansas City	168	MPE
		Bismarck to Sioux Falls	315	MPE
⑨	National Air Line System	St. Petersburg to Jacksonville (via Daytona Beach)	237	MPE
⑩	National Airways, Inc	Boston to Bangor	213	MPE
		Boston to Burlington	193	MPE
		Burlington to Montreal	73	PE
⑪	National Parks Airways, Inc.	Salt Lake City to Great Falls	489	MPE
⑫	North American Aviation, Inc. (Eastern Air Lines Division)	New York to New Orleans (via Atlanta)	1296	MPE
		New York to Miami (via Charleston, S. C.)	1144	MPE
		Chicago to Miami (via Jacksonville, Louisville & Nashville)	1267	MPE
⑬	Northwest Airlines, Inc.	Chicago to St. Paul (via Rochester)	356	MPE
		Chicago to Pembina (via Milwaukee)	769	MPE
		Fargo to Seattle	1267	MPE
		Pembina to Winnipeg	65	PE
⑭	Pan American Airways, Inc	Miami to Havana	229	MPE
		Miami to San Juan	1180	MPE
		San Juan to Paramaribo	1378	MPE
		Paramaribo to Buenos Aires	4840	MPE
		Miami to Cristobal (via San Salvador)	2228	MPE
		Miami to Cristobal (via Kingston & Barranquilla)	1810	MPE
		Barranquilla to Port of Spain	1021	MPE
		Miami to Nassau	188	MPE
		Tampa to Havana	339	PE
		Brownsville to Mexico City (via Tampico)	496	MPE
		Mexico City to San Salvador	951	MPE
		Kingston to Port au Prince	304	PE
		Port au Prince to Santo Domingo	161	PE
		Belem (Para) to Manaos	852	PE
		Vera Cruz to Merida	530	PE
⑭a	Pan American Airways, Inc. (Aerovias Centrales)	Los Angeles to Mexico City	1684	PE
		El Paso to Durango	663	PE
⑮	Pan American-Grace Airways, Inc.	Cristobal, Canal Zone to Montevideo, Uruguay (via Santiago, Chile)	4552	MPE
⑯	Pennsylvania Airlines & Transport, Inc.	Washington to Detroit	410	PE
		Detroit to Milwaukee	265	MPE
⑰	Seattle-Victoria Air Mail, Inc.	Seattle to Victoria	74	M
⑱	Transcontinental & Western Air, Inc.	New York to Los Angeles (via Chicago, Kansas City & Amarillo)	2503	PE
		New York to Los Angeles (via Columbus, Indianapolis & Kansas City)	2555	MPE
⑲	United Air Lines Transport Corp.	New York to San Francisco (via Chicago)	2647	MPE
		New York to Chicago (via Philadelphia & Kylertown)	747	PE
		San Diego to Seattle	1161	MPE
		Agua Caliente to San Diego	14	PE
		Seattle to Vancouver	119	PE
		Salt Lake City to Seattle (via Portland)	816	MPE
		Pendleton to Spokane	169	MPE
		Kansas City to Chicago	410	PE
⑳	Varney Air Transport, Inc	Pueblo to El Paso	519	MPE
㉑	Watertown Airways, Inc	St. Paul to Spearfish	559	PE
㉒	Wedell Williams Air Service Corporation	Houston to New Orleans	329	MPE
㉓	Western Air Express Corp	San Diego to Salt Lake City	702	MPE
㉔	Wilmington Catalina Airline, Ltd.	Wilmington to Avalon	31	PE
㉕	Wyoming Air Service, Inc	Cheyenne to Pueblo	199	MPE
		Billings to Cheyenne	380	MPE

ACTIVITIES AT THE SCHOOLS

Facilities Expanded

THE DEPARTMENT of Aeronautical Engineering at the University of Minnesota has added new aircraft, and engine laboratories, a meteorological observation and study room, and new offices totalling 8100 sq. ft. in floor area. At the same time the Department is retaining all of the facilities in use at present. Howard W. Barlow has been promoted to the position of assistant professor in Aeronautical Engineering, and Mr. Henry W. Salisbury who was at the University on a temporary basis has been appointed to a permanent position as Instructor in Aeronautical Engineering.

The Instrument Shop of Boeing School of Aeronautics is to be expanded to occupy over twice the space now allotted to it. Improvements designed to keep pace with new developments will be made. Raymond Stephan is now in charge of the shop.

Parks Air College has finished equipping the weather observatory. Primary work will be offered to every student in the school now while the advanced work will be restricted to Executive School students.

Dallas Aviation School plans to construct a dormitory for student fliers at Love Field, Dallas. The dormitory will be built on a 150-ft. square lot on the north side of the field and will cost $15,000. The new building, of steel, brick and concrete, will provide accommodations for 100 students and will be completed by October. Present dormitory accommodations will be moved to the new building.

Enrollments Continue Climbing

STUDENTS ENTERING aviation schools throughout the United States have not decreased during summer months according to reports which indicate enrollments keeping pace with the increasing interest in aviation.

Curtiss-Wright Technical Institute of Aeronautics at Grand Central Air Terminal in Glendale, California, had nine new enrollments during the month of June and from early indications twice the number of enrollments were expected in July as there were in June.

An increase of student enrollments for the July term of 50 per cent as compared with July, 1934, is reported by Parks Air College. Students from distant points such as Penang in the Malay Straits Settlement; Tel Aviv in Palestine, and Pietermaritzburg in Union of South Africa are enrolled.

Ryan School of Aeronautics reports that present enrollment is the largest since the school moved to Lindbergh Field three years ago. Approximately 75 per cent of the students are enrolled for flight and ground school courses. The majority of the remaining 25 per cent are enrolled for the school's new twelve-month master mechanic's course.

Casey Jones School of Aeronautics, Inc., started 32 new students in its July class which opened on the 15th of that month. This brings enrollment to capacity, over 300.

Personnel Changes

PARKS AIR College of East St. Louis, Ill., has made two new additions to the faculty. Virgil I. Pinkstaff will instruct in economics and the principles of accounting and finance in the Executive school, and Ralph B. Wagner will instruct in Business English and salesmanship.

Eddie A. Schneider, former Junior Transcontinental record holder and now manager of the Jersey City Airport has severed his connection with U. S. Aero Units and has started the Schneider Flying School. He has purchased a new Aeronca for students and is also buying a Kinner-powered Fleet for advanced students. Ground school courses will be held once a week.

George Matthews, head of the sheet metal department of the Ryan Aeronautical Co., has been appointed instructor in charge of this branch of ground school training for master mechanics students at the Ryan School of Aeronautics .

Amelia Earhart has accepted appointment to the advisory staff of Purdue University, at Lafayette, Indiana, as consultant in the Department devoted to the study of careers for women. Miss Earhart has been a frequent visitor to the Indiana institution, in which aviation has become of major importance both from an engineering and from a vocational standpoint.

Alan F. Bonnalie, director of technical instruction for the Boeing School of Aeronautics, was recently made Squadron Commander of Naval Reserve Squadron VN14RD12, relieving Lieut.-Commander F. B. Connell, who remained as commanding officer of the Naval Reserve Aviation Base at Oakland Airport. He has been associated with the Naval Reserve since 1926.

T. Claude Ryan, president of the Ryan School of Aeronautics, San Diego, announced the appointment of Floyd Adams as chief shop instructor. Adams is a transport pilot and one of the aerial pioneers of Alaska.

Graduates Placed

FIFTY-ONE POSITIONS in the aviation industry were filled during the first four months of this year by graduates of the Boeing School of Aeronautics, according to the school's placement bureau, and Parks Air College reports the placement of 61 graduates this Spring with airline and aircraft companies in the United States and South America.

Eleven former students of the Curtiss-Wright Technical Institute of Aeronautics found positions in the industry during a recent 30-day period.

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AN ANNOUNCEMENT of VITAL IMPORTANCE

to every man considering Aviation Schools

The three Chief Pilots of United Air Lines have been appointed to act as a Flight Advisory Board at the Boeing School of Aeronautics

CAN you think of any men better equipped to plan your flight instruction course than the pilots of "United"?

Addems . . . Williams . . . Lewis . . . veterans of line flying. The three executives who inspect and counsel the 150 pilots of the line that "flies more passengers, more planes, more mail, more miles, than any other line in the world."

Now their experience is *directly* at the service of the Boeing School.

As the members of the Boeing School Flight Advisory Board, it will be their duty to help keep flight instruction at the school even more closely co-ordinated with developments in the aviation industry itself.

And at graduation, they will personally interview and fly each Boeing School pilot for his final approval.

This supervision of Flight Courses supplements the actual training by the Boeing School corps of instructors headed by George Myers, Director of Flight Instruction, who was a veteran transcontinental mail pilot before assuming charge of Boeing flight training in 1929.

In every department of instruction, both flying and ground school courses, you benefit by this school's significant difference in purpose:

Boeing School, alone of all air schools, has been established and maintained by an airline to develop the type of trained men needed by the air industry.

That is why Boeing School is known for its long hours of intensive, serious work. And why the equipment and courses at Boeing School are *so much more complete.* At Boeing, you fly *bigger* ships. Even the primary training planes are heavier and of higher horsepower (165 h.p. to 210 h.p.) than those in use at certain other schools. And advanced flight training is given in transport-type ships of up to 1350 horsepower.

In the 9 shops and laboratories at Boeing you use standard airline equipment. You thoroughly learn 30 *modern radial engines* . . . use distillation apparatus, viscosimeters, oxidizers and centrifuges to investigate the characteristics of fuels and lubricants . . . make static and dynamic tests on airplanes for which ordinarily only an airplane factory is equipped . . .

Is it any wonder that when you graduate from Boeing, you are far better qualified than the average to earn your way to worthwhile jobs and promotion?

Under 18 full-time instructors, Boeing School offers a broad, complete range of 9 practical courses—ranging from a nine-month ground course at a tuition cost of $600 to the 24-month Boeing Airline Pilot and Operations course—tuition $5800—which totals 4015 hours of shop and apprentice work, lecture, airline operations, instrument and landing beam instruction, and dual and solo flying in 9 different types of planes.

Enrollment is restricted at Boeing School. If you are seriously interested in preparing for a worthwhile career in aviation, write today for full information and enrollment requirements. Rates from $600 upwards; courses from 9 months to 2 years, starting quarterly. Convenient payment plan. Mail coupon today.

▪ ▪ ▪

BOEING SCHOOL
OF AERONAUTICS
DIVISION OF UNITED AIR LINES

BOEING SCHOOL FLIGHT ADVISORY BOARD

WALTER ADDEMS, chief pilot eastern division, United Air Lines. 16 years in aviation. 850,000 miles in the air.

WARREN D. WILLIAMS, chief pilot midwestern division, United Air Lines. 14 years in the industry, with a record of over a million air miles.

HAROLD T. LEWIS, chief pilot western division, United Air Lines. A pioneer of the Coast-to-Coast air mail. 20 years in the industry. A million miles in the air to his credit.

PLACEMENT

Boeing makes no promises of finding graduates jobs. It is a fact, nevertheless, that in 1933-34 the number of graduates to find placement equalled 84% of the number graduated in those years. And during the first 6 months of 1935, 80 graduates have secured positions.

NEXT REGULAR ENROLLMENT SEPTEMBER 30

Boeing School of Aeronautics, Dept. F-8, Airport, Oakland, California

Gentlemen: I am interested in the courses indicated:

- ☐ Boeing Airline Pilot
- ☐ Transport Pilot
- ☐ Limited Comm'l Pilot
- ☐ Private Pilot
- ☐ Amateur Pilot
- ☐ Airline Mechanic
- ☐ Airline Operations
- ☐ Airline Pilot and Operations
- ☐ Airline Technician (Open to Engineering graduates)
- ☐ Special Airline Pilot (For Transport Pilots only)
- ☐ Home Study Courses (For those employed in the industry)

*Name*____________________*Age*________

*Years in High School*____________*Years in College*________

*Address*____________________*Phone*________

*City*____________________*State*________

AT THE AIRPORTS

New Airports Contemplated

THE BILL providing for a lake front airport off Sixteenth Street in Chicago has been signed, finally removing all barriers which have previously held up the construction of the project, which has been consistently sponsored by Mayor Kelly, and approved by Relief Director Hopkins, who has indicated that government funds will be made available for its speedy construction.

After many delays it appears that Nashville, Tenn., will have a new A1A municipal airport. A site selected by Bureau of Air Commerce officials has been approved and will be purchased by the city. The plot contains 447 acres and is 6.5 miles from the center of town. Space for two 5000 ft. runways will be provided, and construction will be done with federal aid.

Charles H. Dion, technical advisor of the State Aviation Commission, has requested cost estimates for construction of a modern airport on the site of the Hammondsport, N. Y., field where Glenn Curtiss conducted his pioneering aviation experiments. The proposed field would be on the Newark-Buffalo airline.

The Jamestown, N. Y., City Council is expected to act on the selection of a suitable airport site to be developed as a TERA project. With the abandonment of the private field there, Jamestown is now without an airport and need of a field has been stressed by businessmen in the community.

Members of the Jonesboro, Ark., Water and Light Plant board voted to buy the site of the municipal airport and to lease the land to the city for 10 years. The city was holding a five-year lease on the property which was sold by the liquidating agent. Federal authorities already have spent approximately $11,000 on improvements.

The following fields in Michigan have been approved for construction or improvement under the 5th enrollment period of the CCC Camp personnel: (New fields): Detour, Grand Marias, Stony Point, Inland Point, Escanaba River, Lake City, Sagola, Marinesco, Watersmeet, Foster City and Big Lake. (Fields to be improved): Hessel, Two Hearted, Three Lakes, Hillman, Onaway, Grayling, Brevort, Mackinac Island, Gwinn, Indian River and Harrison.

Sites Surveyed For Radio Flying Units

ANTICIPATING EARLY delivery of necessary equipment, which has been on order for several months, the Bureau of Air Commerce, Department of Commerce, completed preparations for surveying sites adjacent to 12 airports for the installation of the adopted radio compass system for blind approaches.

Sites selected are Newark, N. J., Pittsburgh, Pa., Columbus and Cleveland, Ohio, Indianapolis, Ind., Chicago, Ill., St. Louis and Kansas City, Mo., Los Angeles and Oakland, Calif., Seattle, Wash., and Washington, D. C. The installation at Washington, D. C., will be for experimental purposes. The first two sets to be delivered will be installed immediately at Newark and Washington.

The radio blind landing transmitters are being made for the Bureau by the Army Air Corps at Wright Field.

Rex Martin, Assistant Director of Air Commerce for air navigation, will be in direct charge of the survey and installation work. He will be assisted by E. A. Cutrell, Bennett Griffin, A. J. LaBaie and W. S. Hinman, Jr.

In addition to the Army Air Corps radio installations, the Bureau contemplates the installation of a chain of lights on a straight line of approach to the principal runway of the airport for a distance of 2,700 feet. Further, two rows of lights flush with the ground are to be installed down the center of the runway. These lights will provide visual direction to the pilot after he has ceased to use his radio for locating the approach to the edge of the airport.

2,343 Airports in United States

CALIFORNIA HAS more airports and landing fields than any other state in the country, according to a report issued by the Bureau of Air Commerce. On July 1, 1935, there were 2,343 airports and landing fields in operation the Bureau announced, and of these, 693 were partially or fully lighted.

The total included 717 municipal and 539 commercial airports, 277 Department of Commerce intermediate landing fields, 619 auxiliary fields, 59 Army airdromes, 26 Navy air stations, and 106 miscellaneous government, private and state airports and landing fields.

California had 198 fields while Texas was second with 135, and Pennsylvania third with 121. Texas had the largest number of municipal airports, 55; Pennsylvania led in number of commercial airports with 70.

New Companies Formed

RIDENOUR FLYING Service, of Wichita Falls, Tex., has been granted a state charter. Incorporators are G. F. Ridenour, Una Ridenour and S. P. Gose; and Aero Service, Inc., has been formed at Canton, Ohio. Incorporators of this company are Karl Schumacher, Leon D. Sherrick, and Willard C. Thomas.

Phenick Flying Service inaugurated a new passenger service at Port Columbus with a tri-motored airliner for local sightseeing and charter trips. The company has been operating in Newark, Ohio, and will continue its service there.

Lee Flying Service has been organized at the Sullivant Avenue airport, Columbus, Ohio, to engage in student instruction, passenger flights, aerial advertising, aerial photography and charter trips. Officers are J. P. Stone, president; H. A. Lee, treasurer, and A. B. Leist, secretary.

Inland Airlines, Inc., is a new air organization with headquarters at Yakima, Wash. Incorporation papers recently filed place capitalization at $10,000, and give as purposes of this new corporation, the operation of passenger, freight and express airplanes.

(Continued on following page)

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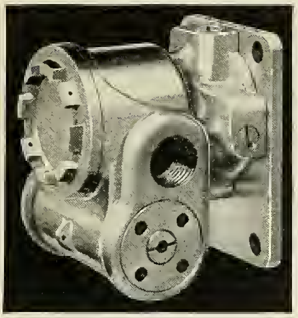
FLIGHT SECURITY



The *NEW* EVANS E-9 *Aircraft* FUEL PUMP

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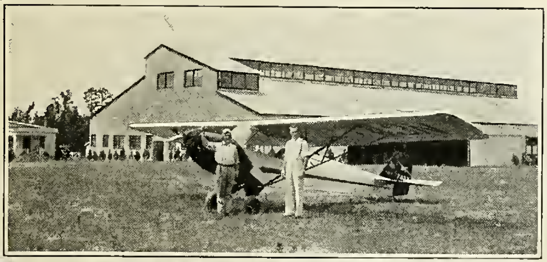

Instructor and Wayman Hall with CUB at Center, Texas.

Learns to Fly for $15.25 in a "CUB"

PAY JUST
$490
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EASY Monthly Payments

HERE'S NEWS to those who hope to fly but think it's too expensive.

Wayman Hall of Center, Texas, learned to fly in a CUB in just 2 hours and 35 minutes . . . at a cost of only $15.25.

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under the sponsorship of the local
or Chamber of Commerce. Tex
kin performed outside loops, and
er performers were Don Coffield, who

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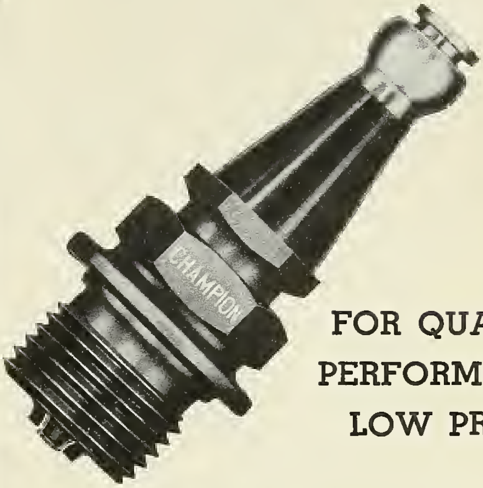

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When you choose spark plugs, consider seriously the reputation, experience and history of the company whose name they bear.

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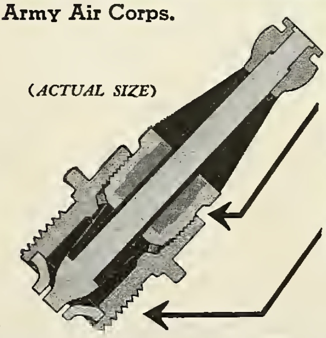
Choose Champions—already used by several leading plane and engine manufacturers; also by the U. S. Army Air Corps.



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NEW METHOD OF SEALING CORE by simultaneous application of enormous heat and pressure, bonds core to shell, guaranteeing gas tightness for life of plug.

NEW DESIGN ELECTRODE AND GAP SHAPE with large area of parallel sparking surfaces increases plug life and means less frequent gap-setting.

Champion M-3-1 Mica Aircraft Plug 18 mm, 11/16" hex with *improved* 4 point gap setting. Price $1.75

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CHAMPION SPARK PLUG COMPANY
TOLEDO, OHIO

(*Continued from preceding page*)

Traffic Heavier at Airports

PASSENGER TRAFFIC moving in and out of Love Field, municipal airport in Dallas, was heavier during June this year than any previous month in the history of the municipal airport. Transport planes carried 2,236 persons into the port, and left with 2,242. This record surpasses by a wide margin the previous high mark set in April.

Traffic at the Buffalo, N. Y., municipal airport during May more than doubled its volume over the corresponding period of last year, Parks Commissioner Frank A. Coon announced in reporting that 4,862 passengers checked through the air terminal as compared with 2,121 last year. During the month, 568 planes arrived, compared with 355 last year.

Averaging better than 200 transport revenue passengers every day in June, Union Air Terminal for the fourth consecutive month eclipsed all previous air travel records with an all-time peak of 6,022 patrons. Totals for the first six months of 1935 likewise registered an increase of 51% to establish a new high figure of 26,087 revenue airline passengers, as against 17,327 for the corresponding period last year, according to President Fred Denslow.

Seaplane Base Development Planned

A COMPREHENSIVE plan for the development of local docks and maintenance facilities for seaplanes, flying boats and amphibions has been placed in the hands of 220 mayors of cities on navigable waters of the United States, by the Marine Air Terminals Committee of the Aeronautical Chamber of Commerce under the direction of its chairman, George B. Post. Inspired by the number of inquiries from municipalities seeking information as to the kind of facilities best suited to their respective localities, a preliminary survey disclosed the fact that fewer than ten communities in the United States have properly equipped docking and maintenance bases for over-water aircraft.

Airports for land planes have stimulated private flying, aerial services and other miscellaneous activities, including the training of a pilot reserve for the national defense. The committee feels that marine terminals will do the same for over-water flying. Adequate landing floats, fueling and storage bases, which comprise the practical marine air terminal, will develop the use of over-water planes at relatively little cost, the committee feels.

Improvements Made at Many Fields

AFTER 17 months of intermittent work, the Princeton, Wisc., municipal airport is completed. Two 1500-foot runways have been constructed and markers placed to outline the 40-acre project, now considered one of the finest of the smaller landing fields in the state. The work cost about $14,000.

The municipal field at Dothan, Ala., is to be completed with the aid of county works relief funds. G. B. Morrison, relief director, said an appropriation of $4,500 would be allotted the airport provided the city sets aside a sum of $1,450. The city council has already made the appropriation.

Approval of the Muscle Shoals, Ala., airport sale to the Tennessee Valley Authority has been given by Muscle Shoals City Council. Hangars are to be built to house TVA planes which will be stationed there.

A surveying crew has completed work preparatory to the installation of blind landing equipment at Lambert-St. Louis Airport, St. Louis. Ground apparatus is being furnished by the Bureau of Air Commerce.

Through efforts of the Airport Committee of the Junior Chamber of Commerce, Brooklings, S. D., now has under construction a hangar measuring 62′ × 82′ and made of concrete blocks with a full concrete floor. The hangar is to be completed by September 1.

Construction of an asphalt floor and apron at the Carbon County, Utah, airport hangar has been started and will soon be finished according to James Lund, superintendent. The work is part of an extensive improvement program contemplated at the port, including more runways and the installation of lights.

Two new concrete runways, 5,500 and 3,500 feet long and 150 feet wide, and a seaplane ramp to be used as a terminal for a proposed aerial ferry service from Floyd Bennett Field to the Manhattan waterfront are among the improvements to be made there out of the $1,625,507 Federal expenditure tentatively approved by the Works Progress Administration.

The longer of the runways would be equipped with the necessary blind landing apparatus. In conjunction with the seaplane base, which is to be situated directly across Flatbush Avenue from the administration building, it is planned to construct a connecting passenger tunnel beneath the street. Other loading tunnels of the same sort would lead from the waiting room to the airport itself.

Three Airports Dedicated

THE AIRPORT at West Yellowstone, Mont., was dedicated, a number of ships from Montana, Idaho and Colorado being present for the celebration. Located west of the city limits and providing one runway 5000′ × 500′; the entire area has been cleared and when finished will have three runways.

Franklin, Va., officially opened its new municipal airport recently, bringing to a climax the extensive efforts of Miss Catherine Vaughan, who has been endeavoring to have a field opened in her city for the past thirteen years. Daughter of the late General Vaughan, and sister of Cecil Vaughan, president of the Vaughan bank in Franklin, Miss Vaughan was instrumental in obtaining PWA funds with which work on the field could be inaugurated. Grading has been completed, and at present there are two runways open for use.

The official opening of Clarke Field, the municipal airport at Ocean City, New Jersey, was held July 4, 1935. Acquired in 1929, the airport tract consists of 124 acres.

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W CATALOG

PRIVATE FLYING AND CLUB NEWS

Air Meets and Races

WITH THE summer race season in full swing, various localities are staging flight shows which are drawing thousands of spectators and doing their share to create an even wider interest in flying and aviation than is being evidenced in the past few months.

The Sixth Annual Soaring Contest, held at Elmira, N. Y., during one of the worst floods in the history of the state, found its activities seriously curtailed, but despite the difficulties eight days were suitable for soaring. Ninety-six pilots were entered with 40 gliders, although only 31 gliders actually were flown. During the meet 29 pilots earned C ratings, 10 new B certificates were granted, and 65 applied for the annual sporting license issued by the NAA. Qualified distance flights of approximately 330 miles were flown, and more altitude flights were made than in any previous contest.

Mrs. Allaire duPont established a new contest record for women when she soared the new Bowlus-duPont secondary glider for 5 hours 31 minutes, and Mrs. Dorothy Holderman soared for 5 hours 3 minutes reaching an altitude of 1024 feet. Richard duPont again was awarded the Edward S. Evans Trophy symbolical of America's Soaring Champion.

Flying news was made in Indiana when 56 planes made the Seventh Annual State Air Tour sponsored by the Indiana Aircraft Trades Association. Two records were made this year—first no other state tour has been successfully flown seven consecutive times, and second, with 56 planes participating, a new high was set in that department.

Air races were held at Lima, O., Altoona, Pa., and at Walla Walla, Wash., during the past month. The largest crowd, 40,000, turned out at Lima to see the show featuring the novelty stunt and inverted flying of Harold Neumann, Lieut. Joe Mackey, Gordon Mougey, Art Davis and Bob O'Dell. The event was held at the municipal airport under the auspices of the local Veterans of Foreign Wars. Clem Sohn made his bat wing parachute jump and Bill Sweet was at the microphone of the public address system. At Stultz Field, Altoona, more than 8,000 persons witnessed the flying program which attracted 16 planes. Four of the visiting planes participated in the 25-mile race won by A. C. Pottoroff who averaged 140 m.p.h.

Walla Walla's show attracted upwards of 5,000 persons for the two-day show held under the sponsorship of the local Junior Chamber of Commerce. Tex Rankin performed outside loops, and other performers were Don Coffield, who won the 18-mile race; W. O. Wickstrom, the 30-mile race, and Bert Zimmerly, who won another special 30-mile race.

For races in the future, it has been reported that the dates of the All American Air Races at Miami have been advanced one month, and this year will be held December 12, 13, and 14, instead of in January as in the past. The race program is now being planned.

Clubs Make Plane Purchases

THE ST. JOSEPH Valley Aviation Club, South Bend, Ind., has placed an order for a new light two-place plane, the fifth the club has owned since its inception in 1928. By promoting airmeets and other activities the organization has earned more than $29,000, and now has a membership of more than 200. At a recent election of officers Wm. J. Ames was elected president; W. A. Redmer, vice-president; H. Bender, secretary.

A new plane was purchased by the Harford Flying Club, Harford, Md., to replace the one lost recently.

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THE INDUSTRY IN GENERAL

Aircraft Show Held In Detroit

THE ALL - AMERICAN Aircraft Shows were revived after a lull of three years when the 1935 version officially opened July 20 for a run of eight days.

Under the direction of Ray Cooper, this year's affair drew about ninety exhibitors and about thirty aircraft, in addition to those kept on the field for flight demonstration purposes.

The show was featured as a Sportsman Pilot event, and accordingly a sportsman pilot race attracted considerable attention. The race was flown from Lunken Airport, Cincinnati, to the Ford Airport and was won by Larry Schmidlapp who was awarded a trophy presented by *The Sportsman Pilot* magazine.

Sales totalling approximately $125,000 were consummated during the first few days of the show. Beech Aircraft sold three planes, and Waco, Porterfield and Rearwin each disposed of one. In addition, Taylor Aircraft placed an order for 100 Continental engines.

Among the planes exhibited in the municipal airport hangar were a Taylor Cub. three Porterfields, a Stearman, Vought Corsair, Boeing Fighter, Grumman FF-1, Northrop Gamma, four Wacos, Stout Sky Car, Boeing pursuit, Consolidated attack, Boeing P-26, Vultee, Luscombe Phantom, Aeronca, Rearwin Sportster, Ryan ST, two Beechcraft and a Fairchild.

1934 Production Worth $44.000.000

AIRCRAFT, ENGINES, equipment and spare parts valued at $44,144,448.54 were produced in 1934 by the American civil aeronautics industry which employed more than 18,000 persons during that period according to the Bureau of Air Commerce.

The value of airplanes and parts was $25,399,078.06, and the 1,615 airplanes produced represented a gain over 1933 and ended a downward trend in production statistics which started in 1930.

Ten captive and six free balloons were produced during the year. The value of the lighter-than-air craft, plus spare parts, totaled $252,523.15.

Number and value of engines were not included in the totals for aircraft, but were compiled separately. In all, 2,545 aircraft engines were built which, together with spare parts, were valued at $15,825,127.14. Total value of propellers, parachutes and pontoons was $2,667,720.19.

The totals cover all aeronautical production, including aircraft and equipment for civilian use, for military deliveries and for exporting to foreign countries.

Employees of aeronautical manufacturers totaled 18,701. These included 11,249 factory and 2,260 office employees of airplane manufacturers, a total of 13,509 and 4,137 factory and 1,055 office employees of engine, propeller and accessory manufactures, a total of 5,192.

Insurance Rates Lowered

PRESENT CONDITIONS obtaining in the industry have brought about rate concessions and broadening of policy conditions to policy holders of Aero Insurance Underwriters.

Fire and windstorm rates on industrial aid risks will be reduced, as will basic public liability and property damage rates. The reductions on the latter are $10 and $5 per aircraft respectively. Liability policies will be broadened by naming approved pilots flying the insured aircraft as additional insureds without extra premium. This extension will also be made without charge for the benefit of the principals of business organizations when using any insured aircraft owned by the organization.

Night flying will be included without additional premium except where passenger liability and crash coverages are taken, when the usual loadings will apply. On metal aircraft fitted with an approved remote control carbon-dioxide extinguisher, a discount up to 10% will be allowed from the fire (ground only) rate.

Pioneer Distributor Named

Bredouw-Hilliard Aeromotive Corp., Kansas City, has been appointed Midwest and South distributor for Pioneer instruments and will serve the manufacturers and airlines in those states. The company is also distributor in the same territory for Wright. Jacobs and Kinner engines and parts; Bendix products; General tires and tubes; Berryloid dopes and finishes; and Flightex fabric and tapes.

May Exports $1.410.837

AN INCREASE in sales of American aeronautical equipment abroad in May brought the total valuation for the first five months of 1935 to $7,019,713. May business in foreign countries amounted to $1,410,837 with 39 aircraft and 51 engines, valued at $836,324 and $195.793, respectively, accounting for the greatest share of the income. Sales of parts and accessories amounted to $375,445, and of parachutes $3,275. April, 1935 sales amounted to $1,343,839, and May, 1934 exports were $844,181.

Sales in the Netherlands accounted for the largest number of planes and engines. Twelve aircraft and six engines, with a valuation of $526,538 and $36.546, respectively, together with $9,848 worth of parts and accessories, made that country our best customer during the month. China, as usual, was among the highest purchasers, taking eleven aircraft, valued at $207,350, twenty engines at $38,880, and $20,664 worth of parts and accessories. Russian buyers spent $56,019 for parts and accessories to lead in this group, but Argentina was not far behind with $37,515.

Other countries in which aircraft were sold were: Hong Kong (4); Argentina (3); Colombia (2); and one each in Italy, Switzerland, Canada, Costa Rica, Panama, Mexico and Barbados.

Forty-nine countries did business with American aviation companies during May.

Allison Expands for New Engine

GENERAL MOTORS Corp. has begun extensive rebuilding and enlargement of its plant at Indianapolis, the Allison Manufacturing Co., to provide facilities for the manufacture of a new 1,000 h.p. aircraft engine of liquid-cooled design.

The new engine has been under development for several years, and it is expected that the Indianapolis manufacturing facilities will be ready for use within a few months. Four new buildings are being built at the Allison plant, to include a manufacturing unit 122′ × 250′; an engine test unit, 50′ × 122′; a carpenter shop and storage unit, 50′ × 90′ and a power house 32 ft. square.

Part of the old Allison plant will be torn down.

(Continued on following page)

Side and three-quarter front views of the new Hammond Model Y exhibited and flown at the Detroit Show

Every transport airplane on every airline in America is equipped with

SCINTILLA

AIRCRAFT MAGNETOS

AMERICAN AIRLINES
Chicago, Ill.

BOSTON MAINE AIRWAYS
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BOWEN AIR LINES
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GENERAL AIR LINES
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GORST AIR TRANSPORT
Seattle, Wash.

HANFORD AIRLINES
Sioux City, Iowa

LICON AIRWAYS
Islip, N. Y.

LONG & HARMAN, INC.
AIRLINES, Dallas, Texas

NATIONAL AIRLINE
SYSTEM, Chicago, Ill.

NATIONAL AIRWAYS
Boston, Mass.

NEW YORK AIRWAYS
New York, N. Y.

NEW YORK AND SUBURBAN
AIRLINES, New York, N. Y.

NORTHWEST AIRLINES, INC.
St. Paul, Minn.

PACIFIC SEABOARD AIR
LINES, Memphis, Tenn.

PAN AMERICAN AIRWAYS
New York, N. Y.

PENNSYLVANIA AIR LINES &
TRANSPORT CO., Pittsburgh, Pa.

RAPID AIR LINES CORP.
Omaha, Nebr.

REED AIRLINES
Lawton, Okla.

ROBERTSON AIRPLANE
SERVICE COMPANY
Robertson, Mo.

SALT LAKE-GREAT FALLS
AIRLINE, Salt Lake City, Utah

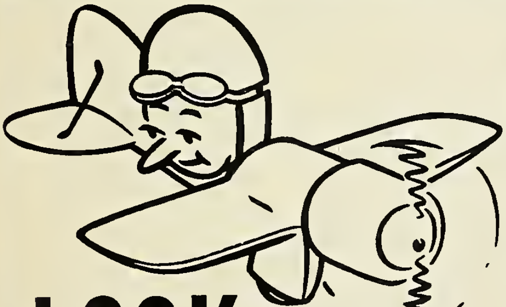
T W A, INC., Kansas City, Mo.

UNITED AIR LINES
Chicago, Ill.

LINEAS AEREAS
OCCIDENTALES, S. A.
(Western Air Lines)
Burbank, Calif.

WEDELL-WILLIAMS AIR
SERVICE, New Orleans, La.

WYOMING AIR SERVICE
Casper, Wyoming



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AT THE ALL-AMERICAN AIRCRAFT SHOW
DETROIT CITY AIRPORT

BERRY BROTHERS

BERRY BROTHERS

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This New Popular Airplane!

THE New Rearwin "Sportster" wins friends immediately because it is an outstanding achievement in airplane design and construction. Smart, Classy, Sporty—streamlined throughout. A marvelous plane for the money! Dual controls—commodious, comfortable cabin. Perfect visibility. 24-gallon fuel tanks in wings. Hydraulic landing gear. 70 H.P. LeBlond motor. Costs only a cent a mile to fly! Just the airplane for student training and sport flying or long trips.

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Write or wire for complete specifications. Check and double check with other airplanes selling for less than $2,000.00. You'll be surprised.

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FAIRFAX AIRPORT
Kansas City, U. S. A.

Interior of the new Stinson Reliant showing upholstered hammock seats and how luggage may be stowed beneath them

(*Continued from preceding page*)

More Planes Sold

SALES OF commercial and military aircraft are keeping pace with production, which thus far this year is exceeding 1934 figures by a considerable margin.

Two Kellett autogiros were sold, one going to Capt. Ramon Franco, who purchased a K-3 with which he intends to make an extensive good-will tour through South America on his return from Spain where he is now making a short sojourn. An order has also been received from the U. S. Army Air Corps for an experimental autogiro. It is understood extensive experimental and research tests will be carried out with this machine for the purpose of determining service specifications of autogiros for use with the ground troops. This is the first experimental autogiro program undertaken by the Army Air Corps.

R. H. Depew, Jr., and Beckwith Havens, Fairchild distributors, Roosevelt Field, report the sale of a new Fairchild "24" three-place cabin monoplane to Cornelius von E. Mitchell, of New York City, and Lambert Aircraft Corp., sold three airplanes during the first half of July for future delivery. The purchasers are Dr. I. O. Wilkerson, Bryan, Tex.; R. W. Horsfield, Topeka Kan., and W. D. Owen of Atlanta, Ga. Delivery was also made on two Monocoupes, one of them going to Bradford Lippincott, Philadelphia, and the other to Melvin Holbrook, Providence, R. I.

First European order to the Wiley Post Aircraft Corp., at Oklahoma City was crated for shipment to Holland recently. Although some of these planes are operating in Mexico and Canada, this was the first overseas shipment, according to John Burke, in charge of the factory. The plane was consigned to the Koch Garage at Amsterdam.

Howard Hughes has returned to California in a newly acquired Beechcraft, one of the new models powered by a Wright Cyclone engine.

(*Continued on following page*)

Digest of Recent Events

French Flyer Establishes Record For Light Planes

THE WORLD'S record for light land planes flying over a 1000-kilometer course was established by Maurice Arnoux who piloted a Caudron low wing monoplane over the 621-mile course at an average speed of 292.825 k.p.h. (181.844 m.p.h.) at the international Angers air race in France. JULY 7

Ingalls Sets Non-Stop East-West Record

THE DISTINCTION of being the first woman to fly the East-West Transcontinental route non-stop fell to the lot of Laura Ingalls when she flew from the municipal airport of New York City, Floyd Bennett Field, to Burbank, Calif., in 18 hours 19.5 minutes. Although hers was the first successful non-stop flight between coasts, Miss Ingalls' attempt did not quite exceed the record of 17 hours 7 minutes 30 seconds, held by Amelia Earhart.

Miss Ingalls flew a Pratt & Whitney Wasp powered Lockheed, carrying 600 gallons of fuel and 40 of oil and equipped with a Hamilton Standard controllable pitch propeller, Sperry gyropilot and radio compass. She was awarded the Harmon Trophy for women in 1934 by reason of her 17,000-mile solo flight which took her on a circuit of South and Central America. JULY 11

Three U. S. Glider Records Established

THE LAST DAY of the Sixth Annual National Soaring Contest held at Elmira, N. Y., witnessed the establishment of 3 new American records for motorless flight. The day's first mark was set when the Soaring Society officials got 20 sailplanes and gliders into the air at the same time—the largest mass flight of this sort ever witnessed in this country. The other 2 records were established by Mrs. Allaire C. duPont who reached an unofficial altitude record estimated at 3,600 ft., and a duration mark of 5 hours 31 minutes. Both are new American gliding records for women. JULY 13

Martin Flying Boat Carries 24,000-Pound Load

CARRYING A payload of 24,000 lbs. at 18,200 feet, the four P. & W.-engined Martin Flying Boat built for Pan American Airways set a world's record when it took off from Middle River, Md., and completed the flight which lasted several hours. The plane is undergoing flying tests before being delivered to its owners. JULY 17

Stoppani Flies 3103 Miles Non-Stop

THE WORLD'S non-stop distance record for seaplanes was recaptured by Italy when Mario Stoppani flew a Zappata-designed plane powered by a Isotta Fraschini 750 h.p. engine from Monfalcone to Berbera, British Somaliland, a distance of 3,103 miles. Stoppani's flight, which exceeds the French record by 392 miles, consumed slightly less than 25 hours, during which the plane flew at an average speed of 124 m.p.h. Accompanying Stoppani were Capt. Casimiro Babbi as second pilot and Sergeant Major Amedeo Suriani as wireless operator. JULY 17

Solberg Starts Flight From New York to Norway

NEW YORK AND Norway are being joined by a seaplane making a trip by easy stages under the command of Thor Solberg and Paul Oscanyan. The plane took off from New York and at this writing had successfully completed hops to the Seven Islands, the north shore of the Gulf of St. Lawrence and Cartwright. JULY 19

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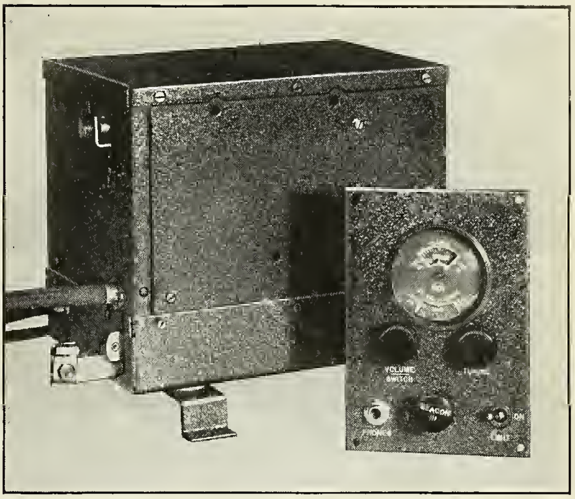

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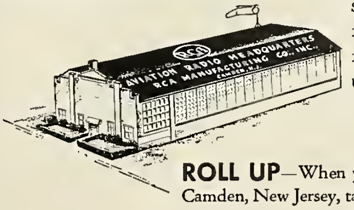

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AVIATION RADIO SECTION

RCA MANUFACTURING COMPANY, INC. CAMDEN, NEW JERSEY

(Continued from preceding page)

Engines Rated on Cruising Performance

PRATT & WHITNEY engines will in the future be indicated by their "cruising rating" instead of by the power available only for limited periods, according to a new policy just initiated by the company for engine ratings. This change has been brought about because of the fact that airplane "cruising" performance, the basis of all airline schedules, is dependent upon the available cruising power of engines and not upon the power which the particular engine can produce on a dynamometer for a limited period.

As a further element in making engine performance conform to actual service requirements, Pratt & Whitney is now providing increased take-off power in all engine models to meet the need of high wing loadings of present-day transport designs and the demand for high propeller thrust for rapid acceleration. Accordingly, all engine parts have been adequately strengthened to guarantee high take-off horsepower without sacrifice of dependability.

Every engine on the current commercial production list except the Wasp Jr. Model SB is equipped with full automatic valve gear lubrication and can be equipped with the recently developed Pratt & Whitney automatic mixture and power control. The combined use of the automatic mixture and power control and the Hamilton Standard constant speed propeller now provides accurate automatic control of cruising power and fuel consumption with maximum cruising performance at any selected cruising altitude.

Cruising Rating and Take-Off Power of P. & W. Engines

Engine	Wasp "400"	Wasp Jr.	Hornet "525A"	Hornet "525B"	*Twin Wasp Jr. "525"	*Twin Wasp "600A"	*Twin Wasp "600B"
Model	S1H1-G	SB	S1E-G	S2E-G	SB-G	SB-G	S1B-G
Take off power (h.p.)	600	450	800	800	825	950	950
Cruising rating (h.p.)	400	300	525	525	525	600	600
Cruising r.p.m.	2,000	200	2,000	2,000	2,200	2,150	2,150
Maximum altitude (ft.)	11,800	9,600	12,800	9,500	12,000	11,000	9,000
Max. power & r.p.m. for continuous emergency	550	400	750	750	750	850	850
Operation	2,200	2,200	2,250	2,250	2,550	2,450	2,450
Bare weight (lbs.)	883	596	1,015	1,015	1,109	1,250	1,250

* Not available for foreign sale.

The accompanying table lists those Pratt & Whitney engine models offered the aircraft industry and shows the new cruising ratings and increased take-off powers. All have a propeller ratio of 3:2 and use Octane No. 87 fuel. The Wasp Junior, however, has a propeller ratio of 1:1.

Bureau Completes Auto Engine Test

THE BUREAU of Air Commerce has just completed official tests of the first standard automobile engine to be inspected for a government certificate permitting its use in aircraft.

The required 50- and 100-hour tests were successfully completed on a standard 1935 Plymouth engine, with Melvin J. Perrin, inspector of the Bureau, supervising the work in the Chrysler dynamometer laboratories under an arrangement with Chrysler's Amplex Division.

New Company Chooses Officers

STOCKHOLDERS OF the newly formed Bell Aircraft Corp., Buffalo, N. Y., have organized and elected a board of directors of five members. The directors have been chosen officers.

Directors are Lawrence D. Bell, formerly vice-president and general manager of the Consolidated Aircraft Corp.; Ray P. Whitman, formerly vice-president and director of Consolidated; Robert J. Woods, formerly designing engineer of Consolidated; Walter C. Lindsay and William J. O'Connor, both attorneys in the office of Dudley, Stowe & Sawyer.

Officers elected are Mr. Bell, president; Mr. Whitman, vice-president and treasurer, and Charles L. Beard, secretary and assistant treasurer. Mr. Beard formerly was assistant to the treasurer of Consolidated.

Work on the design of models to be submitted for government inspection has been started by the corporation which already has taken over the old plant of the Consolidated corporation, at 2050 Elmwood Avenue, and set up temporary offices in the Arco Building, 1807 Elmwood Avenue. About Sept. 1, Bell Aircraft will take over 40,000 square feet of the Consolidated factory, which is owned by the American Radiator Co.

United's Subsidiaries Consolidated

AT STOCKHOLDERS' meetings of The Pratt & Whitney Aircraft Co. Hamilton Standard Propeller Co., Chance Vought Corp., and Sikorsky Aircraft Co., these subsidiaries of United Aircraft Corp., voted to consolidate into one company to be known as United Aircraft Manufacturing Corp., which also has acquired the assets and will carry on the operations of The United Airports of Connecticut, Inc., according to Donald L. Brown, president.

The change was made solely to provide the United Aircraft group with a simplified corporate structure, Mr. Brown said, and implies no change in personnel or in the duties of personnel as maintained under the former set-up. None of the former subsidiary companies loses its identity in that the old names have been set up as divisions and will be maintained as such in the future.

(Continued on following page)

COMING EVENTS

The Midwest Aviation Exposition, under the direction of Capt. C. R. Bowers, manager of the Bendix Municipal Airport will be held at that field for two days. August 3-4

•

An air meet and dedication of its municipal airport will be held at Lancaster, Pa., Aug. 17-18

•

International Aerial Competition will be held under the auspices of the Royal Aero Club of Italy at Rome. There will be a tour and an aerial competition held in conjunction with the event. August 24-30

•

An Outdoor Motor Regatta and Aircraft Display will be given at Gallipolis, Ind. Cash and valuable prizes will be awarded. August 25

•

America's Schools of Aviation Day at the California Pacific International Exposition, San Diego, Calif., will feature a complete aviation program. August 25

•

The 1935 National Air Races will be held at the Cleveland Municipal Airport under the direction of Cliff and Phil Henderson. Aug. 30-Sept. 2

•

Results of preceding Regional Airport Meetings will be discussed in Birmingham, Ala., Sept. 7

•

The Aero Club of Buffalo will again sponsor a series of air races at Buffalo, N. Y., Sept. 7-8

•

The Sixth Annual Coffeyville, Kans., Air Meet and Air Races will be held at the Coffeyville, Municipal Airport. Sept. 8

•

The Fifth Annual Meeting of the National Association of State Aviation officials is scheduled Detroit, Mich. Sept. 26-28

•

The Eighth Annual All-American Air Races will be held at Miami, Fla. Dec. 12-14

•

An International Aero Exhibition will be held in Stockholm, Sweden, May 15-June 1, 1936

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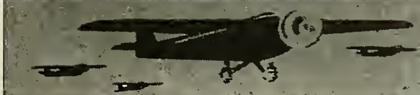

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Major "Al" Williams, Lecturer and advanced flying Instructor.

Hugh Copeland, Transport Pilot and Chief Ground and Mechanics Instructor.

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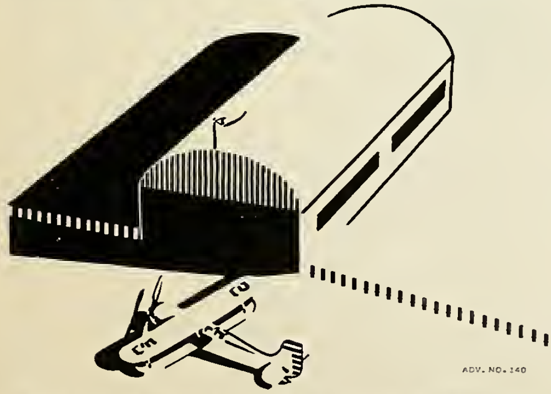

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THE LAIRD STANDARDWING

Another LAIRD winner—no matter how you look at it. Three place. Powered with Wright J-6, 285 h.p. Does 150 m.p.h. wide open, cruises at 135 m.p.h., and lands at 45 m.p.h. Cruising range, 600 miles. Equipment includes metal prop, lights, RCA radio, brakes, starter.

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One of the snappiest—in performance and style—open cockpit planes in the air. Three-place. Powered with 300 h.p. Wright engine (or P & W Junior), 175 m.p.h. top, 155 m.p.h. cruising; 55 m.p.h. landing. Cruising range 550 miles. Equipment includes brakes, variable-pitch prop, lights, compass.

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(*Continued from preceding page*)

Personnel Changes

LIEUT. WILLIAM L. MAXSON has resigned from the U. S. Navy to become consulting engineer for the Fairchild Aerial Camera Corp., Woodside, L. I., according to Sherman M. Fairchild, president of the Fairchild Aviation Corp. Lieutenant Maxson will specialize on the development of Fairchild military and commercial products. At the time of his resignation from the Navy he was assigned as executive officer to the destroyer U. S. S. *Ried,* now constructing.

O. S. Reasor has joined the Kellett Autogiro Corp., as Chief Inspector, and the following engineers have joined the Engineering Department under the supervision of Chief Engineer, R. H. Prewitt: James P. Rigby, Rudolph Lopez, Bruce Cassell, and Edward R. Miller, Jr.

J. G. (Tex) Rankin has been elected chairman of the new Oregon State Board of Aeronautics, at its initial meeting. Webster A. Jones was elected secretary of the board, and was instructed to assure commercial operators, transport lines and private fliers that the board desires to cooperate with them and give their fullest efforts to the futherance of aviation to the state. Mr. Rankin was authorized to represent the board in Washington, D. C. in connection with airport development in Oregon, which will be done through federal aid.

Approved Type Certificates

THE BUREAU of Air Commerce of the Department of Commerce has issued the following approved type certificates covering aircraft during the past few months.

Cessna Aircraft Corp. Model C34, four-place closed land monoplane powered by a 145 h.p. Warner Super Scarab engine.

Rearwin Airplanes, Inc. Model 7000, two-place closed land monoplane, powered by a 70 h.p. LeBlond 5DE engine.

Waco Aircraft Co. Model CUC, four-place closed land biplane powered by a Wright Whirlwind 250 h.p. engine.

Fairchild Airplane Co. Model 24 C8-D, three-place closed land monoplane powered by a Ranger 6-390B 145 h.p. engine; Model 22 C-7G two-place open land monoplane powered by a 145 h.p. Warner Super Scarab engine.

Bellanca Aircraft Corp. Model 31-50, six-place closed land monoplane, powered by a Pratt & Whitney S3H1 Wasp engine of 550 h.p.

Kellett Autogiro Corp. K-3 autogiro, wingless direct drive type.

Camera Corporation Expands Plant

EXPANSION OF the Fairchild Aerial Camera Corporation's plant at Woodside, L. I., by one-third to handle increasing production of the Fairchild Kruesi Radio Compass for aircraft and expansion of camera exports were announced by Sherman M. Fairchild, president of the Fairchild Aviation Corp.

More than 10,000 square feet of floor space has been added to the present facilities. Among other projects the camera company is producing more than 500 radio compasses for the Air Corps, Department of Commerce, and for commercial aviation use.

Increasing scope in the company's export business was also evidenced in that during the first six months of this year, aerial cameras and allied equipment were exported to 20 countries compared to only seven in the same period last year and only 13 in the entire year of 1934.

Menasco Buys Cirrus Assets

MENASCO MANUFACTURING Co., Los Angeles, Calif., has purchased the assets of the A. C. E. Corp., of Marysville, Mich., obtaining a small inventory of new Cirrus engines. The company is now equipped and stocked to offer service on Cirrus engine parts and supplies.

The A. C. E. Corp., manufactured the Cirrus Upright Mark III, an ATC engine of 90 h.p. at 2100 r.p.m. and the Hi-Drive Mark III, a 95 h.p. engine also approved by the Department of Commerce. Both are four cylinder, inline, direct drive, air-cooled engines.

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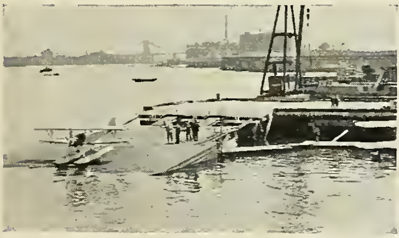

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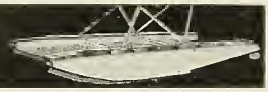

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FOREIGN NEWS IN BRIEF

●

Australasia

FLYING A Puss Moth, H. F. Broadbent made a new record for a round Australia flight of 3 days 9 hours 54 minutes. The distance was approximately 7150 miles, and exceeded the previous record held by Melrose in the same plane by 49 hours.

TWO MONOSPAR planes have been delivered to New England Airways, Ltd., the first of a number ordered by the company. The new planes are capable of cruising at 140 m.p.h., and have a top speed of 158 m.p.h.

OWING TO the business possibilities offered on the England-Australia air service, investigations are being made into the possibility of establishing a more frequent service, possibly twice a week instead of once a week. However, it is unlikely that any decision will be reached until the return from London of F. McMaster and A. E. Rudder, of Qantas Empire Airways, who are studying the use of larger planes to cope with the increase of mail.

AUTHORITY HAS been given by the Australian Government for Qantas Empire Airways, which operates between Singapore and Brisbane, to carry passengers. The England-Australia route was opened for passengers east of Singapore with the service leaving London April 13.

Canada

VANCOUVER TO Montreal in fifteen hours is predicted when plans to make the trans-Canada airway a reality are completed within the next two years.

Supplementary estimates laid before Parliament contain an appropriation of $500,000 for preparatory work such as the construction of airports, landing fields, night lighting, radio facilities, and other accessories. Already 49 fields have been completed. Extensive investigation will be carried out through trial flights, for the determination of the best routes and ascertaining atmospheric conditions.

Military flying will be advanced by an additional grant of $500,000 for maintenance and training, which will permit an increase in the personnel of the Royal Canadian Air Force.

CANADA'S 1935 aviation showed a good start for the year with the issuance of the first quarterly report which recorded 285,163 pounds of air mail, nearly half of that carried in 1934 which was the record year for air mail in the Dominion. Twenty-seven air mail routes were operated during the first three months of 1935, and 1404 trips were scheduled.

Of the 22 government-sponsored flying clubs operating, all but the Ottawa club increased activity during the first quarter of 1935, with 1803 members, 76 planes and 526 members under instruction. The clubs flew 1437 hours during the period.

Civil government operations were at a minimum during the first three months, flying only 146 hours of which more than 100 hours were for transport work in connection with the geological survey being made this summer by 180 prospecting parties under the government's relief work.

At the end of March there were 413 private pilots licensed, 424 commercial pilots, 456 air engineers, 38 private planes, and 322 commercial ships, as well as 103 airharbours.

MORE THAN 2,000 inquiries regarding the Colonial and Dominions enlistment plan of the Royal Air Force have been received at Royal Canadian Air Force headquarters in Ottawa since R.A.F. expansion was authorized by the British government.

It was not yet known how many men would be accepted from Canada. Three R.A.F. categories are open: Short service commissions, for which 1,000 inquiries had been received here; permanent commissions and apprenticeships; or positions as airmen, for which another 1,000 inquiries were received.

BROOKS AIRWAYS, Ltd., pioneer Saskatchewan commercial flying organization, has leased its planes and equipment to Wings, Ltd., a Winnipeg firm of commercial flyers, who will establish a base in Prince Albert, using equipment and three planes secured from Brooks and adding to both. W. J. (Bill) Windrum, Brooks pilot, will manage the company's business.

France

A POTEZ 25 equipped with the Clerget Diesel engine recently made a round-trip test-flight between Paris and Bordeaux. On the way back trouble was experienced with the oil circulation and a forced landing was made, prior to which 527.8 miles had been covered in 5 hours.

Work on this 500-600 h.p., 14-cylinder engine has been progressing for some years under the auspices of the Hispano Suiza Company and under the technical service of the Air Ministry.

Great Britain

ONE OF the autogiros supplied last year to the army co-operation squadrons of the R.A.F. for experimental flying. is to be attached to the H.M.S. aircraft carrier *Courageous.*

SIR ROBERT McLean, for the past seven years in charge of the aviation interests of Vickers, Ltd., was appointed chairman of the Society of British Aircraft Constructors, succeeding Herbert J. Thomas, of the Bristol Aeroplane Co., who held the position since early in 1933. Hugh Burroughes, of the Gloster company, was elected Aircraft Deputy Chairman and Air Vice-Marshal A. E. Borton, of D. Napier and Son, Ltd., Engine Deputy Chairman. John Lord, of Saunders-Roe, Ltd., was re-elected treasurer.

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AIRPORT & AIRCRAFT LIGHTING EQUIPMENT

Two P. & W. Hornets of 750 h.p. each power this Douglas for K.L.M.

THE FIRST Imperial Airway's liner in service from London to Brindisi to stop in Italy on the scheduled service to South Africa and Australia, landed at the airport there on May 1.

T. O. M. SOPWITH, chairman of the Hawker Aircraft Company, Ltd., has been named chairman of a new company that is being formed to bring under one control five British companies manufacturing military aircraft. The new company, called the Hawker-Siddeley Aircraft Co., Ltd., is to be formed to acquire the whole issued share capital of the Armstrong-Siddeley Development Co., and half the ordinary share capital of the Hawker Aircraft Co.

The Armstrong-Siddeley Development Co. controls the Sir W. G. Armstrong-Whitworth Co., A. V. Roe Co., Ltd., Armstrong Siddeley Motors, Ltd., and Air Service Training, Ltd., while Hawker Aircraft, Ltd., controls the Gloster Aircraft Co.

THE ROYAL Air Force of Great Britain paraded on July 6 before its King in the first formal air review ever held in England. It was inspected on the ground and then a large section flew past in formation. There were 350 airplanes of all types in the array presented to the King on the ground. There were 182, again representing all types, in the flight review that followed.

Holland

K. L. M. REPORTS that both passenger, freight and mail traffic in January, 1935, showed an increase as compared with the first month of 1934. Passenger traffic to London increased 95% from London 111%, to Paris 74%, from Paris 16%, to Scandinavia 49% and from Scandinavia 12%. Passage receipts to the Amsterdam, Rotterdam and The Hague offices increased 160%, 60% and 14% respectively as compared with the corresponding month of 1934.

ON JUNE 26th K. L. M. inaugurated its first tourist trip covering approximately 20,000 miles in 41 days—passing over three continents and 22 countries—with four and a half weeks in Sumatra, Java and Bali.

Five days after departure from Amsterdam the tourists arrive at Medan, on the Island of Sumatra, the starting point for the tour of Netherlands India. In this time, they flew over the Pyramids to Baghdad, up the Tigris-Euphrates Valley to Calcutta, over Burmah and Siam, then on via Singapore to Medan.

K.L.M. INAUGURATED bi-weekly service over the regular Amsterdam-Batavia route with departures from Amsterdam and Batavia each Wednesday and Saturday. Duration of the 9000-mile journey has been reduced to 5½ days.

ON JANUARY 1, 1935, T. E. Slot moved with his staff from the Pander Works to the Koninklijke Maatschappij "De Schelde," a large shipbuilding concern at Vlissingen (Flushing). After 4 months, an airplane factory is in full operation, a smaller type of the Postjager has practically been completed, and work is progressing on a small metal biplane.

Russia

DAILY SERVICE will be opened this year between Moscow and Tashkent, with K-5 planes, the passenger compartments of which have been remodeled and comfortably furnished. A non-stop service will also be operating this year for the first time between Moscow and Sverdlovsk. Previously the planes landed in Kazan. The Moscow airport is now being repaired, and landing and take-off strips and the waiting rooms are being re-equipped.

ESTABLISHMENT OF an air mail and passenger service between Moscow and Prague was to be inaugurated August 1st. Prague is connected with the important capitals of Europe, and the new service will give direct connection with Moscow, with possibilities of easy access to Paris and the Continent. The line will pass over Kiev and Rumania and then follow the Czechoslovakian airline to Uzhgorod and Prague.

South America

MODERN FLOODLIGHTS have just been installed at Campo dos Affonsos, a military flying field located about 40 miles from Rio de Janeiro. The installation consists of two projectors of 3,000,000 candle power each, which are placed one at each end of the field. The practicability of the lighting apparatus was demonstrated one night recently, when a squadron of army planes took off and landed without difficulty.

THE TRINIDAD Government is considering plans for the construction of a modern airport which, it is estimated, will require an outlay of approximately $240,000. The proposed airport would be constructed at Mucurapo point, near the present seaplane anchorage used by Pan American Airways.

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TRADE LITERATURE

Stanavo Handbook

• THE 1935 edition of the Stanova *Pilot's Handbook* presents in concise and convenient form technical data and general information of interest to aviators.

One of the most important features is the 32-page radio section, which tabulates and describes the aircraft radio facilities maintained by the Department of Commerce. To assure accuracy, everything published in the Handbook is checked with authentic sources, and before final publication each edition is passed upon by several representative pilots.

Requests for the Handbook have been received from practically every country and although most of the information contained in it is designed to aid American pilots, foreign aviators also have found it interesting. Its nominal distribution however, is limited to American pilots holding a Department of Commerce license and to those who will qualify for their pilot's license during the balance of this year.

Aviation Insurance

• AERO INSURANCE Underwriters, New York, have just published a series of pamphlets which should be interesting to those who have not been following recent developments in aviation insurance. One gives the approximate cost of the various coverages written. Another answers most of the questions which a thoughtful student of this subject would ask. Another shows not only where prospects can be found and why they should buy this insurance, but also illustrates the relative cost of aviation insurance as compared to the cost of insurance on ordinary mercantile risks.

Bonney Tools

• INCLUDED IN Catalog 35 issued by the Bonney Forge and Steel Works, of Allentown, Pa., are prices and descriptions of a complete line of tools specially designed for aircraft purposes.

In addition to the wrenches for Wright, Pratt & Whitney and Warner engines, the company also describes a number of miscellaneous wrenches for aircraft use.

Bonney manufactures a complete line of tools for almost any mechanical use or service. The tabulation, price listing and illustration of this line constitutes the major portion of Catalog 35.

Aircraft School

• AN ATTRACTIVE booklet has been issued by the Curtiss-Wright Technical Institute of Aeronautics to show the extended activities of the school at its Glendale, Calif., home. Illustrated profusely, and written in concise form, this publication includes the curriculum offered by the school, and tells of its history and background.

Offering a comprehensive engineering training, the Institute's varied activities are well described by word and picture.

Wood Preservation

• THIS SUBJECT has been comprehensively treated in a most interesting booklet just published by the Tennessee Eastman Corp., Kingsport, Tenn. It deals with the protection of wood against decay, dry rot and termites.

Those interested in wood as a foundation and building material for hangars or other airport structures, will find a wealth of information between the pages of this new booklet. It discusses the various methods of preservation and sets forth definite recommendations for the different types of construction. Practically every page is illustrated with photographs or drawings.

Entitled *Preservation with Eastman NO-D-K,* the booklet has been printed to acquaint the public with this product. The airport owner or manager will find the subject of termites clearly outlined and will be informed how his buildings may be protected from attack. Several pages are devoted to the recommended methods of application.

Timken Bearings

• TIMKEN ROLLER Bearing Co., Canton, Ohio, has just issued the third edition of its Engineering Journal, a series of 8½ by 11" loose leaves, bound in a stiff-cover binder. It has a 22-section marginal tab index for ready reference as well as a detailed index sheet.

The first four sections, comprising 46 pages, cover the design of Timken bearings with illustrations of the various types, a discussion of how they are rated, the curves and factors which apply for speed, life expectancy, engine torque, use or application, and 15 typical examples of how loads are calculated and bearings selected for various applications.

Following the tabular sections of the Journal (50 pages), are the detailed dimension sheet sections (108) pages. Illustrations suitable for tracing are given for all single row bearings and each sheet carries a table of ratings for the bearing shown for various speeds.

The last two sections discuss cup and cone fitting practice for Timken bearings, giving recommendations, and cover also the subject of lubrication.

Supplementing the Journal are seven sections on mine cars, conveyors, shop trucks, cranes, aircraft, machine tools, and farm equipment. The first five give detailed bearing recommendations together with a tabulation of the bearings used for the particular application.

Weston Instruments

• A COMPREHENSIVE 12-page catalog describing aircraft instruments made by the Weston Electrical Instrument Corp. has just been published. The catalog includes specifications and prices for navigation aids; tachometers; temperature indicators for air, oil, carburetor and cylinder temperatures, as well as panel ammeters, voltmeters, etc. A description of the Weston Synchroscope, designed to reduce vibration by keeping engine speeds in synchronism on multi-engined planes, is featured. Panel indicators and various test instruments for aircraft radio applications are also included.

In addition to electrical and mechanical specifications, the catalog contains a group of dimensional drawings to facilitate choice and location of instruments on the available panel space.

Spray Equipment

• A NEW edition of Bulletin AD-114, 2-color, 32-page booklet, issued by the Binks Manufacturing Co., Chicago, gives prices and descriptions of additions to the Binks line of spray equipment. New developments described include the Thor Model 5 Touch-up Gun with adjustable spray head and overhead trigger and the Thor Model 6 Touch-up and General Utility Gun. Also included is the No. 5 Complete Touch-up Outfit.

The bulletin briefly outlines the entire Binks line, including descriptions, prices and illustrations of spray guns for finishing, cleaning and oiling; cut-type containers, pressure containers, oil and water extractors, hose, air regulators, nozzles, compressors, portable spray outfits, spray booths and exhaust units. Helpful suggestions and technical information on the proper equipment for various users are suggested.

Stainless Steel Corrosion

• INFORMATION OF interest to fabricators and users of stainless steel is contained in the pamphlet *Stainless Steels Treated with Columbium,* issued by Electro Metallurgical Co., New York, N. Y. The pamphlet shows how the addition of columbium to the austenitic type of stainless steel results in the elimination of intergranular corrosion. Comprehensive data are given on the physical properties and corrosion-resistance of columbium-treated steels.

These steels, when welded with columbium-treated welding rods, exhibit no susceptibility to grain-boundary deterioration in the "as welded" condition, so that full corrosion resistance is said to be obtained without heat-treatment after welding.

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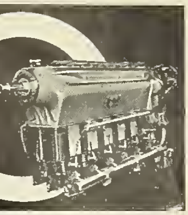

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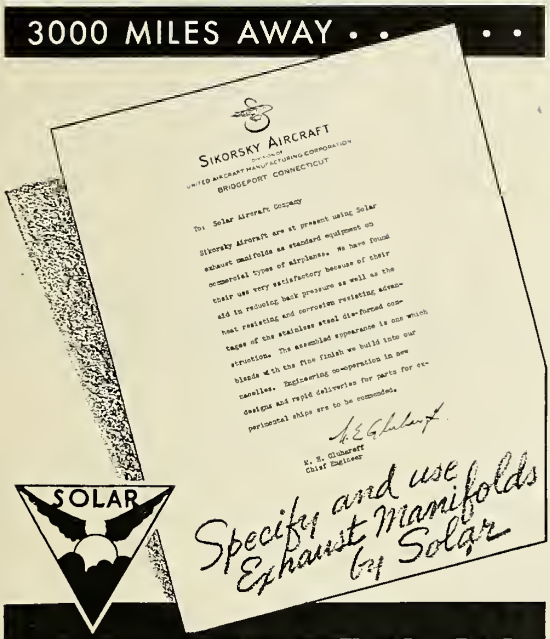

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MONTREAL FLIGHT

(Continued from page 17)

with an American pilot, Bill Eastman, in his Fairchild, while another American pilot, Al Mitten, flew the other Chink along in the fence-crashing Fledgling. When they got back to Swanton, Vt., the American port of customs entry, the Customs officer apparently decided that we had too many Chinamen here now, for he seemed reluctant to let them back in. However, it was explained that they really had a legal right to come back, so they were about to take off when someone discovered that a main spar in the Fledgling had been weaker than the fence the boys had slid through the night before, and that it was cracked. That settled their return, for a time at least.

President Ben Marcuse and members of the Montreal Light Aeroplane Club made our stay wholly delightful. Ben was in charge of the bottled goods and worked like a horse, opening bottles. Even at that he was falling behind when rescue parties dug in to lend aid. That was out at the airport. In the evening we attended a dinner given by the city to the members of the flight party at the "Chez Maurice" and had a mighty nice time, after which some of us went for a drive around the city.

Along about 3 a.m. the Canadians either got tired of us or some of us got lost or strayed away, for a bunch of 8 Americans found themselves standing out in front of the Mount Royal Hotel arranging with the Captain of one of Montreal's oldest sea-going hacks to take us for a drive—it seemed that one of the party wanted to visit his grandmother in Montreal. Well, the 8 of us got into and on top of and under that hack, which was pulled by a horse that should have been stuffed and put away in a museum long ago. You could hang your hat on any corner of him. But he dragged us for a few blocks and we pulled up in front of grandma's. I said to this chap, "I don't think your grandma will want to see us at this time of night." But he only said, "You don't know grandma." He didn't either, as it turned out, or else we didn't have the right address, or grandma had moved, or something. So we drove on, shouting at policemen, who stay out that late just for American tourists to shout at, asking how to get back to the hotel, and when he tells them saying they don't really want to go there, as they're going to stay out all night for a change. Well, we finally did drag back, about four, and then we had a little difficulty trying to get the horse in through the revolving doors of the hotel. We might have got him in, too, only we had forgotten to unhook the cab. Well, it was a great trip, and I only hope that the Canadians, after thinking it over, don't decide to re-arm the border.

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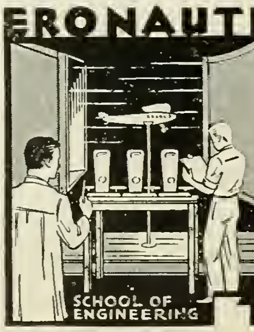

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STINSON LYCOMING SM8A: Perfect, A-1 condition, recently majored. Always hangared, never cracked. Licensed to June 1936. Privately owned. An exceptionally good buy for $1,700. Chas. Boye, 199 Genesee Avenue, Warren, Ohio.

E-107-A AERONCA MOTOR: Completely rebuilt by licensed mechanic. $100, cash. D. Eaton, 125 Carmel, Kalamazoo, Michigan.

WARNER CESSNA: Relicensed; late heads, heavy duty crankshaft and valve drive; best offer takes. Want J-5 Cessna, other ships. Merle Buck, 5609-34th Ave., So., Minneapolis, Minnesota.

CHALLENGER ROBIN: New motor; completely recovered; landing, navigation lights; battery. New seats, tires, glass. Never cracked. Ten hours. Must sell to settle an estate. Price $1,800. Descriptions on request. John Parrott, Kiuston, N. C.

$3000: IN CONVENIENT payments or approximate cash buys Continental Cabin Waco; radio, generator, lights, instruments; 1932 model, less than 300 hours; also 1934 Waco F-3, excellent condition, same terms. Macrombie Airways, Inc., Somerset Hills, New Jersey.

6000-B TRAVEL AIR: 6-place, recovered last March; J6-9 motor; electric starter, generator, radio; Edo 4650 pontoons and Federal skiis. Also OX-5 Millerized Robin, recovered year ago. Reasonable offer accepted for all or any part. Address Peter Klimek, Baudette, Minnesota.

FOR SALE: Arrow Sport, Kinner motor; brakes, bank and turn, navigation lights, compass, air speed. NC 820-M; ship and motor A-1 condition. $975. Ken Morey, Adrian, Michigan.

PARKS P-1 TRAINER: OX-5; licensed December 15th; first class shape throughout; recent major overhaul; priced right. Also: NB-8 Genet, five-cylinder radial 85 h.p. Trade in automobiles or anything. Terms to responsible parties. Colerain Auto Sales, Inc., 2710 Colerain Ave., Cincinnati, Ohio.

FOR SALE: Keystone K-84 Commuter; serial 331. Wright 330 h.p. Total time 200 hours. $2,500 cash. A. J. Hartman, Burlington Airport, Burlington, Iowa.

EAGLEROCK LONGWING: Millerized OX-5. Licensed until July 1936. Duals, DH wheels, refinished; always hangared. Quick sale, $300 cash. Gordon Stoppelbein, 1716 St. Paul St., Rochester, New York.

ENGINES: Majored by approved agency. Hornet B, $1,500; Hornet A-1, $850. Wasp S1D1, $2,500; Wasp C, $1,100; Wasp B, $750. J6-9-D, $1,100; J6-7-D, $775; J-5, $500. Kinner K-5, $300. Lycoming 215 h.p., $675. Babb, 1100 Airway, Glendale, Calif.

WACO C: Four-place cabin; Continental 165. Guaranteed less than 300 actual hours. Privately owned; best possible condition. Very speedy, economical. Sell for $1,875 if at once. Dealers hurry on this bargain. Lohman, 325 San Gabriel Drive, Rochester, New York.

MUST SELL, LESS MOTORS: 6-place Stinson cabin ship, NC licensed. Also 6-place B-5 Ryan, NC licensed, excellent condition, new airwheels, brakes. Less J-6 330 h.p. motors. Will accept good light air-cooled ship on deals. Michigan Aero Motors, Jackson, Michigan.

WARNER PRIVATEER: Licensed until May 1936, $900. 1934 Aeronca, engine just factory majored, $1,175. 1935 Aeronca, 200 hours, $1,350. Tred Avon Flying Service, Easton, Maryland.

SWALLOW OX-5: 3-place biplane, first class condition; never cracked. Licensed June 28. Motor recently overhauled, always hangared. Will sacrifice for $400. Chuck Swartzell, Michigan City, Indiana.

J-5 STINSON JR.: 4-place cabin, in good condition; licensed, dual stick control, motor recently top overhauled. Excellent for barnstorming, cross country, student instruction or building up your time in good safe ship. Make me an offer. W. E. Barton, 1529 W. St. Joseph, Lansing, Michigan.

FOR SALE: Factory overhauled Wright 7-cylinder model R-760-D engine. Karl Ort, 597 W. Poplar Street, York, Pennsylvania.

FOR SALE: Stinson Trimotor, new Lycomings; ship licensed, ready to fly. A bargain. Will fly anywhere for expenses. The Decatur Flying Service, Inc., P. O. Box 495, Decatur, Illinois.

FOR SALE: Rebuilt 7-cylinder LeBlond. 90 h.p. engine. No time since overhaul. Price, $250, f.o.b. Chicago. LeBlond 2-place Inland Sport, licensed 6-15-36, $850. J. B. Dahl, 3661 Archer Avenue, Chicago Illinois.

'32 WACO CABIN: 210 Continental; 150 hours since factory major, 10 since top; 70 gallon gas tank, flares, radio, wings recovered last July; extra propeller, tires, landing lights, always privately owned, never cracked. Deliver for expenses. No trades, no discounts. $2,850, cash. Alfred Burroughs, 238 West Craig, San Antonio, Texas.

FOR SALE: Warner Monocoupe D-145, 150 hours total time, about 10 hours since top overhaul. Vermilion red and cream. Almost like new, $3,000. E. D. McKenzie, 814 Central Avenue, Great Falls, Montana.

6 AIRPLANES FOR SALE OR TRADE: Two J-5 Straightwing Wacos; J6-5 Travel Air; OX-5 Travel Air; Stinson Sr. J6-9 six-place; Heath powered with Wright Morehouse. Trade in your ship or will accept cars of late model. Terms if desirable. Parachutes. Few new Hamilton wood propellers at $15. Flottorp, Marshall and Bennett propellers carried in stock for all motors. Write for details. Central Air Service, Grand Rapids, Michigan.

TRAVEL AIR SPORT: 16-K; 125 h.p. Kinner, speed ring; steel propeller, Airwheels, starter, brakes, lights, other extras; gloss finish. $1,550 cash. Aeronca C-3, $775. LeBlond 65 h.p. engine, overhauled, complete, $150. Full Airwheels, 20 x 8 x 4, complete, $75 pair. Dick Schall, Berwyn, Maryland.

FOR SALE: Travel Air monoplane, 6000-B. 6-place, 330 Wright motor; 25 hours since majored. Electric generator, starter, landing lights. Ship in good condition. $1,950. Charles Towers, Bowman, North Dakota.

FAIRCHILD 24: Cirrus; never cracked up; dual control. Motor just majored. Steel propeller. Total 350 hours, 20 hours since overhauled. Price $1,600. Descomb, 100 Church St., Wethersfield, Connecticut.

WACO GXE: OX-5; just relicensed, NC 9562. Silver wings, vermilion fuselage; red leather upholstering; perfect covering. 287 hours total, only two owners. Never cracked. Pontoon fittings. $650; take car in trade. Gene Lawrence, Frankfort, Indiana.

TRAVEL AIR S2000: OXX-6; motor total time, 50 hours. Extra engine with 500 hours. Licensed until December 1935. Speed windshield, compass, airspeed, pitch and bank, duals. $475. J-5 Fairchild FC-2 1929: 100 hours since overhaul, engine 50 hours since major. Clock, compass, bank and turn, starter, many extras. Fine ship, $1,000. David Rauh, 593, Nantucket, Massachusetts.

KINNER AMERICAN EAGLE: 3POLB, long nose, high cowl, steel prop, air starter, good covering; licensed May 1936, $800. J. W. Lytle, 2333 Vodeli Street, Pittsburgh, Pennsylvania.

FOR SALE: Curtiss Junior, 45 h.p. Szekely, with new license; $390. W. F. Norwood, 810 Wolf Avenue, Elkhart, Indiana.

BARGAINS: J-5 Travel Air, excellent condition, $1,200. J-5 Ryan Brougham; just spent $600 on complete overhaul. $1,050. Curtiss-Wright Junior, motor and ship good, $375. Siemens Travel Air: Air wheels, Hamilton steel propeller; motor and plane good, $650. J-5 motor parts. Carthage Airways, Carthage, Missouri.

GREAT LAKES: Like new, lots of extras. Kinner Bird, perfect shape. Waco 10, new cover, motor overhauled. Used cars and ships accepted as part payment. Will pay cash for good Amphibion and Lycoming Stinson. Municipal Airport, Box 102, Lima, Ohio.

FOR SALE: Travel Air J-5; just overhauled, special paint, racing shields, air speed, bank turn, metal prop, recently recovered; bargain for quick sale. E. L. Luke, San Benito, Texas.

PITCAIRN AUTOGIRO: Kinner, two-place. New set rotors, prop. Completely recovered and refinished; very attractive. Desire $1,500 cash or trade for good Speed Wing job. Hugelen Flying Service, Leland, Iowa.

LATEST KINNER 125 Sportwing: Like new; relicensed to June 1936. 100 hours total, never damaged. Lots extras; clock, sensitive altimeter, turn bank, rate climb, starter, radio, etc. Cost over $4,000. First offer $2,750 takes it. Master Builders, Chandler Building, Washington, D. C.

AERONCA C-3: Land and seaplane. Licensed July '36. 104 hours since new fuselage, spars, prop, fabric. 20 of these on Edo floats, new last Fall. No time on E-113 motor since factory major. $1,775. Also 110 Siemens Kitty Hawk, 512 ship hours, 613 motor; 109 since major. Has oleo, brakes, semi-airwheels. Licensed June 1936. $850. Providence Airport, Seekonk, Massachusetts.

CHALLENGER ROBIN: Good condition, licensed October 15. Goodrich airwheels and brakes, motor recently overhauled; steel propeller. $950. Brayton Flying Service, Inc., Robertson, Missouri.

WACO F, WARNER: 275 hours total; licensed to April 1936. Extras include Hamilton steel prop, cockpit cover, ring. $1,600. D. S. Chairs, 401 Loudon Avenue, Baltimore, Maryland.

FAIRCHILD KR-21: Two-place sport biplane. Kinner motor; metal prop. Airwheels, brakes; 275 hours private use only. Perfect, economical to run. Beautiful for private, training, stunt flying. $1,175 or trade for good Monocoupe. Lohman, 325 San Gabriel Drive, Rochester, New York.

BEST BUYS ON PAGE: Less motors. Kinner powered 2-place side-by-side Red Arrow Simplex monoplane, less Kinner motor, $275. B-1 5-place Ryan cabin ship. Goodyear full Airwheels and brakes, air tail wheel, dual controls, $675 for quick sale, less J-5 motor. Michigan Aero Motors, Jackson, Michigan.

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PLANES AND ENGINES FOR SALE

FOR IMMEDIATE SALE OR EXCHANGE: 12 certified airplanes to choose from, as follows: C-1 Ryan J6-7 4-place cabin ship; one J-5 Straightwing Waco; J6-7 250 h.p. Straightwing Waco; J-6 B-5 6-place Ryan cabin ship, airwheels; J-6 6-place Stinson cabin ship; 1 type 2000 OX-5 Travel Air; 2 OX-5 Curtiss Robins; one OX-5 Waco 90; 185 h.p. Challenger Robin; Continental A-40 powered Heath. All ships NC licensed, ready for delivery. Good late model cars taken on deals. Terms to responsible buyers. Becker-Forner Flying Service, Inc., Jackson, Michigan.

FOR SALE: Jacobs cabin Waco; Eaglet; Straightwing Waco; Kinner Travel Air Sport; Stinson S; Stinson Reliant; Great Lakes; Bellanca Skyrocket; Bellanca Pacemaker; Kinner Fleet; Fairchild 24; Fairchild Warner 22; J6-7 Stearman; Wasp Laird; cracked-up Laird; Monocoupe and Fairchild parts; Wasp C motor. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

LOCKHEEDS: 2 Orions, manufactured 1934. Wing flaps, two-way radio, all Sperry instruments, S1D1 engines, controllable pitch propellers. Cost new, $32,000. Specially priced, $12,500. Vegas, Wasp engines, $5,000 to $7,000. Babb, 1100 Airway, Glendale, California.

WACO F: Warner engine. No time since major overhauled and relicensed. Best offer over $1,450. Wire or write Blevins Aircraft Corp., Candler Field, Atlanta, Georgia.

J6-9 STINSON: 100 hours since major overhaul. Licensed until January 1936, $2,500. B Wasp motor, 50 hours since major overhaul, $575. All prices f.o.b. Wallace Aerial Surveys, Spokane, Wash.

MILLERIZED 3-place OX-5 American Eagle: Dual controls. Total time 165 hours. Licensed March 1936. Private owner must sell. $375. Northeast Philadelphia Airport, Philadelphia, Pa.

STEARMAN C3B: Licensed, J-5; 15 hours since major overhaul. Has many extras including landing lights, starter, etc. Cash, $1,350. Waco 90: Licensed until June 1936, OX-5 recently overhauled, Millerized. Cash, $550. T. Walker, 139 Broadway, Lawrence, Massachusetts.

FOR SALE: The best looking Warner 125 h.p. Cessna in the country. Painted white, trimmed red. Equipped with semi-airwheels, steel propeller, exhaust collector ring, speed ring. Ship completely recovered ten months ago, new upholstery. Motor now being major overhauled. Ship carries four people and baggage, and cruises 115 m.p.h. Pictures furnished upon request. Cash price, $975. Parrish Flying Service, Columbia, S. C.

STINSON S: Completely reconditioned and Lycoming engine major overhauled, with new heavy-duty crankshaft installed. Ship completely refinished and in beautiful shape. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pa.

GREAT LAKES: Late model 2T1A, $950. Excellent condition, painted silver and green. Engine 295 hours, licensed to January 1. J. Ernest Cotter, Chattanooga, Tennessee, Box 367.

J-5 CESSNA: Just relicensed, recently refinished, excellent condition, fast and dependable. $950. Also Russell chest pack parachute with case and harness, used but little, $65. E. E. Foster, Draper, South Dakota.

KINNER FLEET: New wings, special rubber insulated engine mount, air wheels, new cover; will sell ready to fly or any in parts. Also OX Command-Aire Trainer, $300 cash. J. C. Corbett, 1116 East 9 St., Kansas City, Missouri.

WACO TEN: $350. Just relicensed; new covering, wings, tail group, center section. Excellent condition. Douglas Peercy, Box 12, Skiatook, Oklahoma.

TRAVEL AIR 4000: Modernized J6-5, semi-airwheels and brakes, recovered wings and tail, NC licensed; in good shape all around. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

DE LUXE "UIC" Continental Cabin Waco: Motor majored at factory 5 hours ago. New type master rod. Special paint, air starter, air brakes, turn and bank, rate of climb, Western Electric 17A radio with two special headsets, 70 gallon tanks. Total hours, 308. A bargain. Hadley Aircraft, Inc., Hadley Airport, New Brunswick, New Jersey.

J-5 PITCAIRN MAILWING: Good condition throughout; 80 hours since major. Radio, heavy duty storage battery, navigation lights, bank and turn, ice warning, 8-day clock, time recorder, dash fuel gauge, pressure fire extinguisher, airwheels and brakes, speed ring, steel prop, cockpit cover, Eclipse starter; must be sold at once. $995, cash. Earl E. Bach, Box 332, Red Bank, New Jersey.

AERONCA: Cracked, $175; Cessna, cracked, $325; Pitcairn less motor, $40. Three of hundreds of bargains listed in Big Summer Directory sent anywhere 20c postpaid. Used Aircraft Directory, Athens, Ohio.

WARNER FLEET: Air wheels, steel propeller, extra instrument, dual control, A-1 shape. Always privately owned. New paint job. Price, $1,600. Descomb, 100 Church St., Wethersfield, Connecticut.

AMERICAN EAGLE (Shortnose): Kinner front exhaust, Airwheels, ship just relicensed. Boeing "95" Express, Hornet, equipped for blind flying. New Standard 5-place. J-6 Travel Air 4-place cabin. Others. Chuck O'Connor, Barnes Airport, Westfield, Massachusetts.

WACO TEN OX-5: Refinished and NC licensed to June 20, 1936. Motor and ship in A-1 condition. Airwheels, duals. $450. Ray Henry, 1715 Sheridan Avenue, Warren, Ohio.

WACO 4-PLACE cabin: New July 1933. Just relicensed, blind flying instruments, clock, drift indicator, radio, landing lights, flares, generator; Continental 210, just overhauled, total 380 hours. Entire ship in perfect condition. A steal at $3,750. Fenton, Transcontinental Airport, Toledo, Ohio.

KINNER BIRD: 100, just majored by Engine Air Service. Steel prop, collector ring, full air wheels; fabric and general condition excellent. Licensed to July 1936. Price, $1,250. Drawer 591, Lumberton, North Carolina.

DH GIPSY MOTH: Licensed until April 1936. Full air wheels; new paint, orange and blue. Also skiis. First $700 takes everything. Clyde Cole, Gladstone, Michigan.

TRADE OR SELL: OX-5 Waco 10 for small late model car or cash. Airplane and engine completely rebuilt at Ryan Aircraft Corp. Airwheels, excellent instruments. Extra special job. Ryan Hangar, San Diego, California.

CHALLENGER ROBIN: Motor like new, covering good. Eligible for license. Dr. G. S. Klassen, Hillsboro, Kansas.

SACRIFICE: 5-place New Standard D-25 airplane. Ship and motor in perfect condition. Licensed to September 1935. Photograph on request. P. O. Box 897, Hartford, Connecticut.

PARKS P-1: Millerized OX-5; 35 hours on motor since installed two months ago. Relicensed to May 1936. Copper wings, black fuselage. Covering excellent. Compass, airspeed, duals. Spare OX-5. Pictures on request. $550 to take all. Dick Jarvis, 1308 Washington, Cairo, Illinois.

OX-5 COMMAND-AIRE: Being relicensed. Rebuilt, overhauled; lights, booster. Very strong. Obtained through forced sale. Will demonstrate or will deliver for $300, plus gas. A. Stewart, 830 Union Street, New Orleans, Louisiana.

WACO GXE: Licensed to July 1936. New air wheels, new Miller overhead, etc. Beautiful ship. $575. Act quick. Carl Hanson, 614 Market St., Youngstown, Ohio.

J-5 STINSON SM-1: 6-place. Completely overhauled, recovered and relicensed. Bendix wheels and brakes. Price $800. Tom Mettee, Shawnee, Kansas.

FAIRCHILD 21: Kinner K-5 powered. Open two-place, taperwing, biplane. Just relicensed. Ship very good. Motor excellent. $850 cash for quick sale. Reliable Flying Service, Inc., Bristol, Conn.

FOR SALE: One Curtiss C-6 160 h.p. engine, complete. One Szekely 45, complete and in excellent condition. Sensenich Bros., Lititz, Pennsylvania.

SPARTAN: 3-place open biplane. Powered with 130 horsepower Walters engine. $675. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

HISSO WACO with 180 E-4 motor. Licensed, in good condition. Reasonable price. Write Mrs. Dessa Gable, Lansdowne Apartments, Atlantic City, New Jersey.

AERONCA C-3: De luxe. Perfect condition. Like new throughout. 288 hours total time on ship and motor. Motor just majored at Aeronca factory. New propeller installed. Completely recovered six months ago. Equipped for blind-night flight, licensed for one year. Special equipment includes landing and navigation lights, Pioneer compass, electric bank-pitch indicator, air-speed, clock, etc. Has oleo gear with oversize Airwheels and winter enclosure. Owner must sell at once, $895 cash. A rare bargain. J. W. Slager, Transcontinental Airport, Toledo, Ohio.

CHALLENGER ROBIN: Perfect condition; motor has only 86 hours total time. New covering and upholstering; licensed May 1936. $1,000. Terms arranged. Pioneer, care Airport, Syracuse, New York.

CIRRUS GREAT LAKES: Splendid condition, $900. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

STINSON S: 750 hours, 150 since engine major; retractable landing lights, position lights, Wiley flares, clock, leather upholstery. Excellent condition. $1,775. Henson Flying Service, Hagerstown, Maryland.

WARNER WACO F: 400 hours, engine majored, ship excellent condition. C-W Jr., just relicensed, cheap. Want Heywood starter for Warner. Air Activities Airport, West Chicago, Illinois.

FOR SALE: J6-5 Aristocrat; A-1 condition. Completely modernized; wheel pants, fairings and speed ring. Tops 140 miles. 26 hours since major. $1,495. Roy Hamilton, 70 Fort Greene Place, Brooklyn, N. Y., or Hangar 3, Floyd Bennett Field.

CHALLENGER ROBIN: Licensed to July, 1936. Unusually good condition, $1,000. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

FOR SALE: Waco cabin, 210 Continental motor; many extras, special color; excellent condition, privately owned; will consider smaller ship in trade. AERO DIGEST, Box 2120.

CHALLENGER OX-5: Scintilla magneto. Overhead motor. Just rebuilt. Ship perfect. Licensed until June 1936. Will demonstrate. $450. Kenneth Raymond, Wells Cadillac Corp., 25 Vose Avenue, South Orange, N. J. Telephone: South Orange 2-7070.

FOR SALE OR TRADE: Best offer takes late Travel Air, Millerized OX-5; just refinished, just relicensed, instruments both cockpits, "Safety-stick." Will include or sell separately: spare OX-5, prop, fuselage complete, one wing, tail-group, wires, struts, centersection, ailerons. Dufort Flying Service, Inc., Malone, New York.

LYCOMING STINSON: Like new; recently recovered; snappy red and yellow color. Motor majored. Landing lights. Bargain, $1,750. Alton Walker, 600 Graphic Arts Bldg., Kansas City, Mo.

BELLANCA PACEMAKER: J6-9 engine, modernized; no hours since major, 40 hours since completely recovered. New upholstering, one reclining chair, new airwheels, tail wheel, 112 gal. gas, 8 gal. oil; large tail surface, complete instrument board. Ship perfect condition. Black, paneled in yellow. $4,950. Leonard Air Service, Long Beach, California.

WACO CABIN: Latest 165 h.p. Continental, 1932 wire braced; late instrument board, 150 hours since major; no time since top. Steel prop, wheel pants, everything perfect. $2,450. Leonard Air Service, Long Beach, California.

1935 WACO CABIN: Radio, night equipment, turn and bank, rate of climb, 70 gallon tanks, pants. 85 hours, will consider trade. Hartman Waco Sales, Pittsburgh-Bettis Airport, Dravosburg, Penna.

J6-5 TRAVEL AIR: New covering; motor majored; licensed till April 1936. Looks and flies like new. Must sell. $1,150 takes it. 150 h.p. Hisso Eaglerock: Motor has salt-cooled valves. New wings. A dandy ship to knock around in. Licensed till April 1936. $475. Charles West, Hasbrouck Heights, New Jersey.

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PLANES AND ENGINES FOR SALE

J-5 PITCAIRN: No time since major on engine, $995. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

PORTERFIELD FLYABOUT: $1,595 — $1,795. Planes or autos in trade. Terms. Free instructions to purchasers. Advice club formation. Dick Schall, Berwyn, Maryland. Telephone: Greenwood, 1676.

VELIE MONOCOUPE: $500; Aeromarine Klemm Salmson, $600. Waco 10, new covers, $450. 4- and 6-place cabin, $1,000. Warner Stinson, $850. Pioneer, care Airport, Syracuse, New York.

FOR SALE: 3-place amphibion, or trade for Aeronca. Aeronca airplane or parts, one-fourth price. Glenn T. Clark, 803 Sixth Street, Charleston, West Virginia.

FAIRCHILD 24: Warner engine; total time 320 hours; privately owned; excellent condition; starter, battery, other extra equipment. Priced for quick cash sale. No trades. W. Camden, P. O. Box 136, Oklahoma City, Oklahoma.

LAIRD-WASP 420: Cruises 150-160, tops 190. Licensed to September 1935. Perfect shape. Any reasonable cash offer will take it. Trades considered. R. F. Hoey, Hangar 3, Floyd Bennett Field, Brooklyn, New York.

CHALLENGER ROBIN: Licensed June 1936; 4 hours since overhaul; extras, $550. J-5 Taperwing Waco, engine majored, recovered and rebuilt; licensed one year, extras, $1,300. Federal Air Service, Roosevelt Field, Mineola, L. I., N. Y.

FOUR-PLACE Curtiss Robin: 185 Challenger; complete overhaul; paint like new; NC license June 1936; priced to sell. Ravenswood Aero Corp., 5512 N. Western Ave., Chicago, Ill. Ravenswood 6186.

OX-5 BIRD: 2 motors, new fabric; lower right spar cracked. Phone Sacramento 2-6500. Boyles, 154 East 87th Street, New York, N. Y.

GREAT LAKES TRAINER: Good condition, standard instruments, air wheels; $925. Consider trade. John T. Corrodi, Inc., Box 185 Bexley Station, Columbus, Ohio.

AVRO AVIAN: Cirrus-powered, total time 225. Free hangar rent and free instruction. A real buy for $550. AERO DIGEST, Box 2106.

LAMBERT MONOCOUPE: With Edo floats and landing gear. Perfect condition; privately owned. High lustre finish, de luxe equipment; ring, special Kollsman and Pioneer instruments, electric starter, generator, lights, etc. F. E. Hoffman, Hasbrouck Heights, N. J. Telephone: 8-1159-R.

KELLETT AUTOGIRO: 210 h.p. Continental, 42 hours since major overhaul; equipped for banner towing. 165 h.p. Continental also for sale. AERO DIGEST, Box 2119.

WE BUY AND SELL licensed airplanes. At present have a number of private planes, trade-ins, etc., for sale. You can deal direct with owner or advise us the type of ship desired, down payment you can make, and pay balance as you fly. Pioneer, care Airport, Syracuse, New York.

SALE OR TRADE: 180 Hisso Travel Air 3000, excellent condition. Total time 550 hours; brakes, compass. Price $850. Robert Moffitt, 408 S. High St., Muncie, Indiana.

FOR SALE: Buhl Pup; also Pup and Szekely parts. Frog's Flying Field, Inc., East Moriches, New York.

WACO F-3: With only 165 hours. Condition like New. Jacobs engine just overhauled by factory. Extra equipment: Steel propeller, direct electric starter, Lear radio, clock, wheel pants, wing root fairing, landing lights, extra gas tank, special upholstery and black polished finish; $4,200 flyaway DuPont Airport, Wilmington, Delaware.

FAIRCHILD 24: Powered Warner 145. Built January this year. Landing lights, flares, starter, $3,950. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

NICHOLAS-BEAZLEY Trainer: With Genet 80 h.p. motor; licensed for 1936. Full equipment, airwheels, etc. $750. First deposit receives preference. Pioneer, care Airport, Syracuse, New York.

PRICES REDUCED: J6-7 Stearman, J-5 Travel Air, Challenger Fledgling, Kinner Fleet, OX-5 Waco, OX-5 Travel Air, OXX-6 American Eagle, Salmson Eaglet, Taylor Cub and Porterfield Demonstrators. Kinner K-5 engine, Cirrus engine parts. Aero-Ways, Inc., Cleveland Airport, Cleveland, O.

LOCKHEED VEGA: Wasp C; fully equipped and licensed for airline use. Excellent condition. $5,500 cash. Fokker F-10: Wasp; excellent condition; $3,000 cash. Accept smaller plane part payment on Fokker—a great barnstorming plane. Hanford Airlines, Sioux City, Iowa.

WACO CABIN: 1931, excellent condition. Extras: landing lights, upholstering, streamlining. Colors: black fuselage striped; red wings. Total time, 658 hours, 2 since major overhaul. R. Ballmann, 3075 Victoria Blvd., Cincinnati, Ohio.

KINNER BIRD: 3-place, new style heads, brakes, dual control; recently overhauled and recovered; always hangared; extra fine condition, almost like new; licensed to February 1936. $1,250. Dr. V. J. Gragg, Clanton, Alabama.

J-5 TRAVEL AIR 4000: Just recovered, in perfect shape, $1,400. OX-5 Travel Air 2000: Millerized motor, $475. Frank Reimers, 314 N. 4th St., Lafayette, Indiana.

TRAVEL AIR CABINS: S6000-B (three) like new, just recovered; Wright J6-9 motors major overhauled, electric starters, seven passengers, toilets. $2,500, $2,750, $3,250. Western Airplane Distributors, 600 Graphicarts Bldg., Kansas City, Missouri.

KINNER WACO F: Majored and recovered; very flashy, becoming color scheme. Heywood starter and steel propeller; $1,650. Stinson J-5, Heywood starter, speed ring and a money maker; $1,000. Will accept late car of ship in trade. Want Kinner, Warner motor parts; Waco F parts. Irving Swedler, Toledo, Ohio.

1934 WACO C: Jacobs motor, landing lights, perfect condition. 125 hours since new. Warner 145 Monocoupe, 30 hours since new, many extras. Both bargains. Aero Brokerage Service, Roosevelt Field, Mineola, New York.

CHALLENGER ROBIN: 185 h.p., total time 300 hours; ten hours since major overhaul; licensed to June 1936. $975. R. G. Schmitt, 2914 Washington, St. Louis, Missouri.

WACO F: Warner engine, steel propeller, speed ring; excellent condition; total time 550 hours; $1,500. Robert C. George, Bowman Field, Louisville, Kentucky.

MODEL F WACO: With Kinner B-5 engine, Heywood starter, landing lights and flares, 150 hours total time on engine. Sacrifice sale. Les. Edwards, 2435 Kensington Rd., Columbus, Ohio.

FAIRCHILD 24: 2-place, cabin; 125 Warner, latest type, just majored. Extras: Steel propeller, sport type landing gear, air starter, turn and bank, rate of climb, special upholstery. 350 hours. Ship and engine excellent condition. $2,650, delivered any place. Ernst Biedermann, 822 Sandusky Street, North Side, Pittsburgh, Penna.

FOR SALE: NB-8 two-place, Genet powered. One new Fahlin propeller and complete cylinders, heads, pistons and valves for Aeronca E-107-A. A. J. Menard, Spearfish, South Dakota.

FOR SALE: Bellanca Pacemaker; new Wright E motor, total time 180 hours. Landing lights, wheel pants, Townend ring, genuine leather upholstering, rate of climb, turn and bank, special hand rubbed finish, etc. Just relicensed. Priced for quick sale. Basil Sims, Luzier's, Inc., 3216 Gillham Plaza, Kansas City, Missouri.

WANTED TO BUY OR TRADE

WANTED: Bargain, in either 4-place Robin, Model F. Waco, late model Monocoupe, Fairchild 24 or Fleet. Must be in good condition and a bargain. Write all details. Paul Blackwell, 2105 Commerce, Dallas, Texas.

CASH: For your airplane or airplane parts in any condition. Want J-5, J-6 motors and propellers, airwheels and instruments. Write details and price in first letter. J. E. Poisson, 1219 Penn Avenue, Grand Rapids, Michigan.

WILL TRADE Harper two-place low wing monoplane, dual controls, air wheels, Szekely 45 h.p. for Buhl Pup, Aeronca or will sell for cash. W. A. Carpenter, Columbia Station, Ohio.

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WANTED: E-113, E-113A or E-113B Aeronca engine. O. D. Schroeder, Trout Park Airport, Elgin, Illinois.

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WANTED: Used Wright E J6-7 motor, three or four place Amphibion. State condition, price; will consider trade. AERO DIGEST, Box 2121.

WANTED: Airwheels. 7:00 x 4 and 18 x 8 x 3. Also winter enclosure for Aeronca C-3. State condition and price. A. J. Leeward, New Kensington, Pennsylvania.

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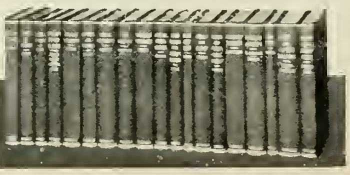

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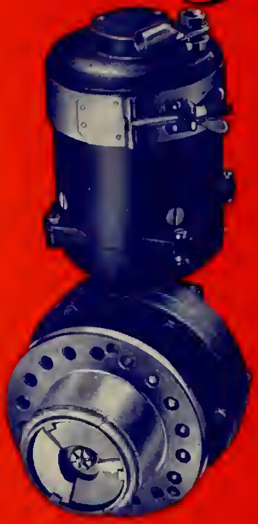

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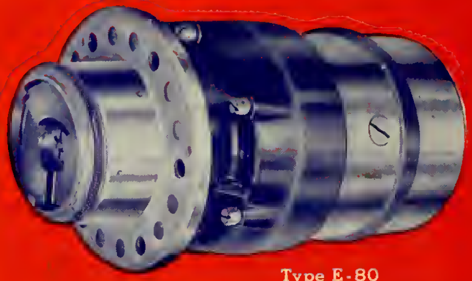

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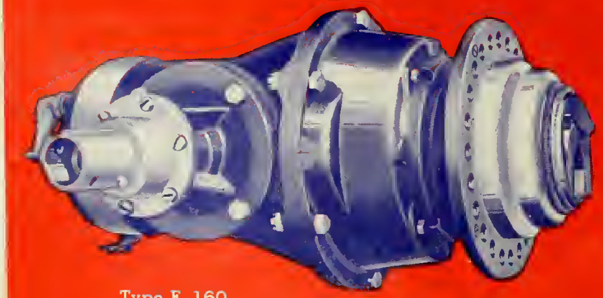

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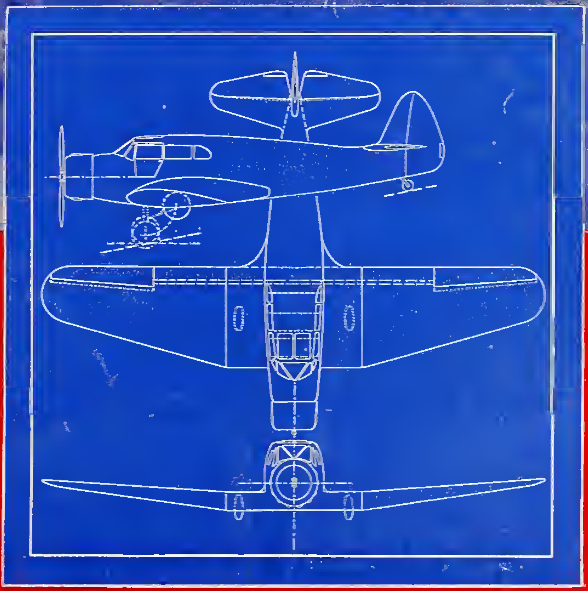

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ECLIPSE

AERO DIGEST, *September, 1935*
Volume 27. Number 3

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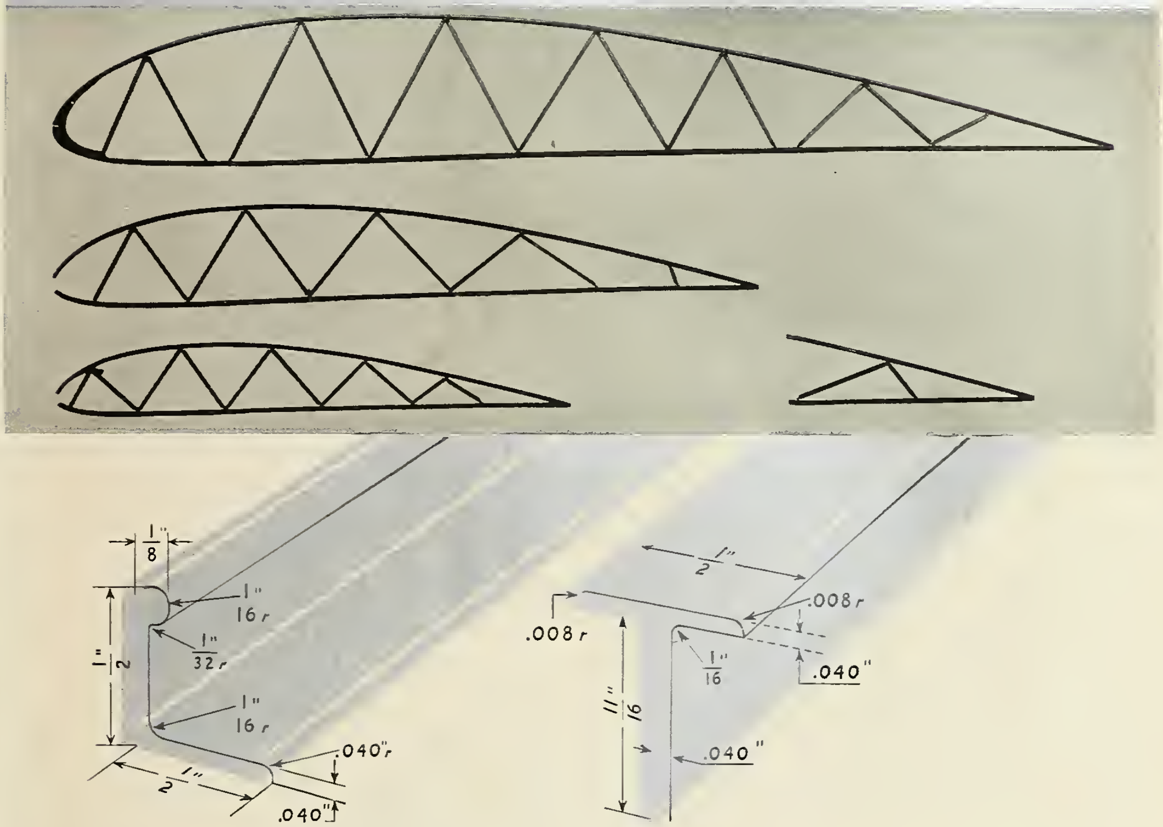

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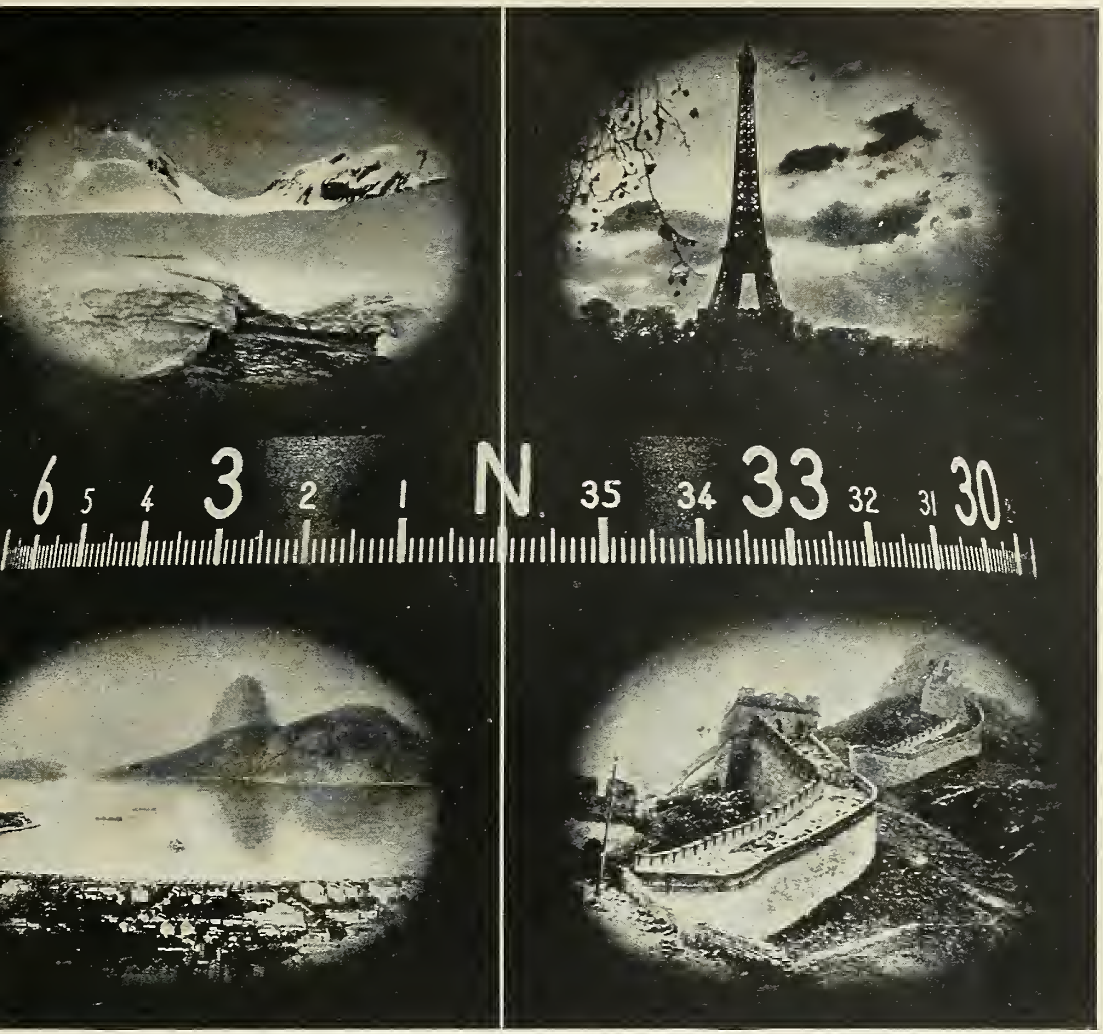

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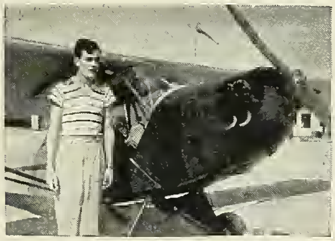

That Parks graduates advance to responsible positions is demonstrated in the fact that this Taylor Cub, photographed at Parks Airport enroute to Memphis from the factory at Bradford, Penn., was built, as are all Taylor Cubs, under direct supervision of Parks graduates. Both the General Factory Superintendent and his assistant are Parks graduates.

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Beechcraft gives to owners of private airplanes performance approached only in the modern equipment used by major airlines, and economy comparable to that of a high-grade automobile.

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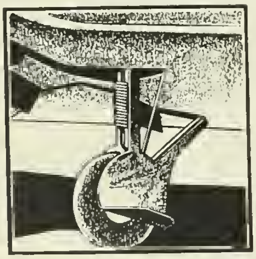
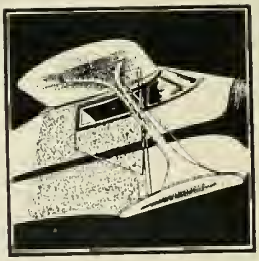


Beechcraft's retractable landing gear is one of the features which makes possible a four to one ratio between landing and cruising speed in Beechcraft model B17R. Lands at 50 m.p.h., cruises at 202 m.p.h.



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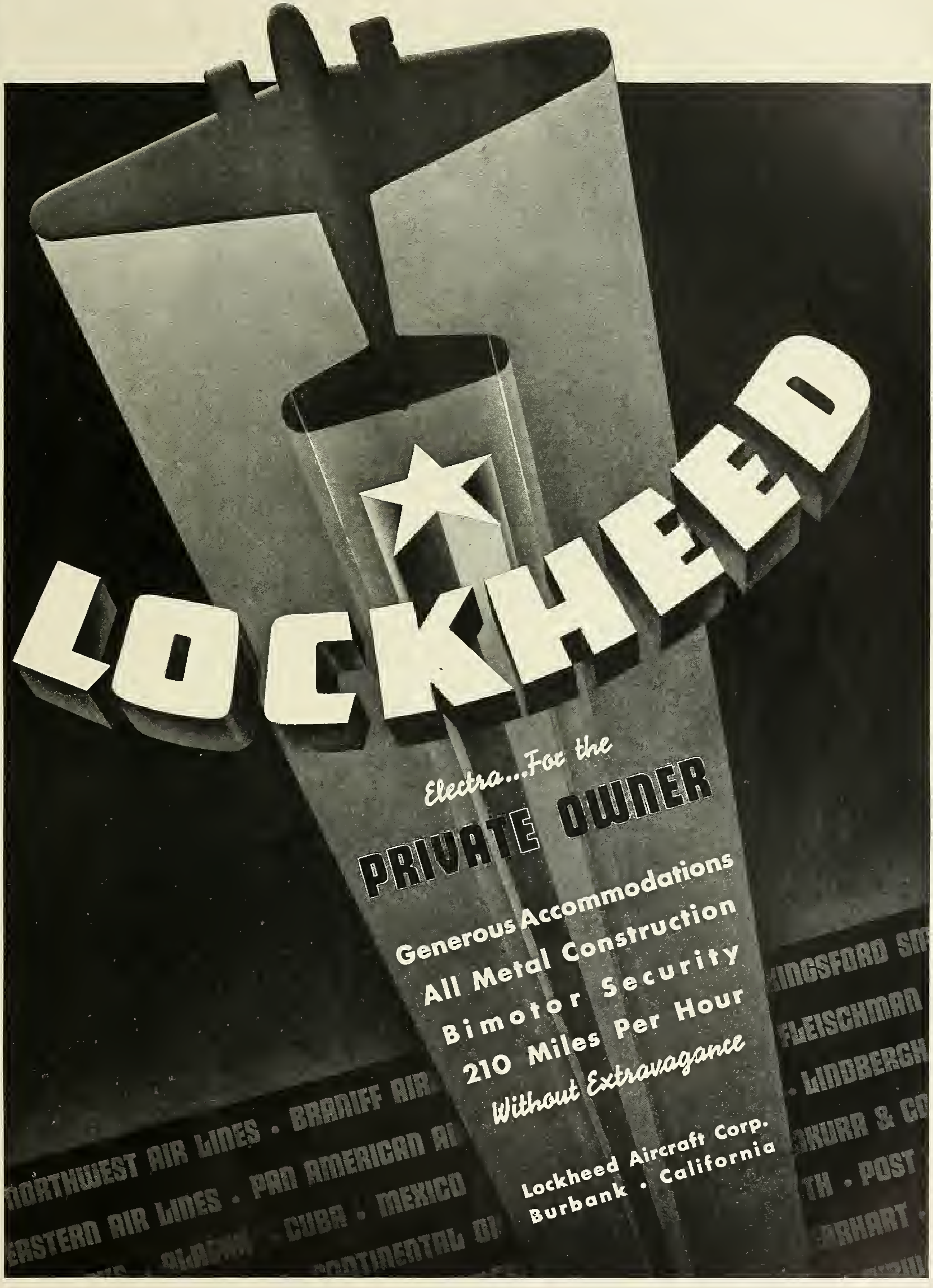

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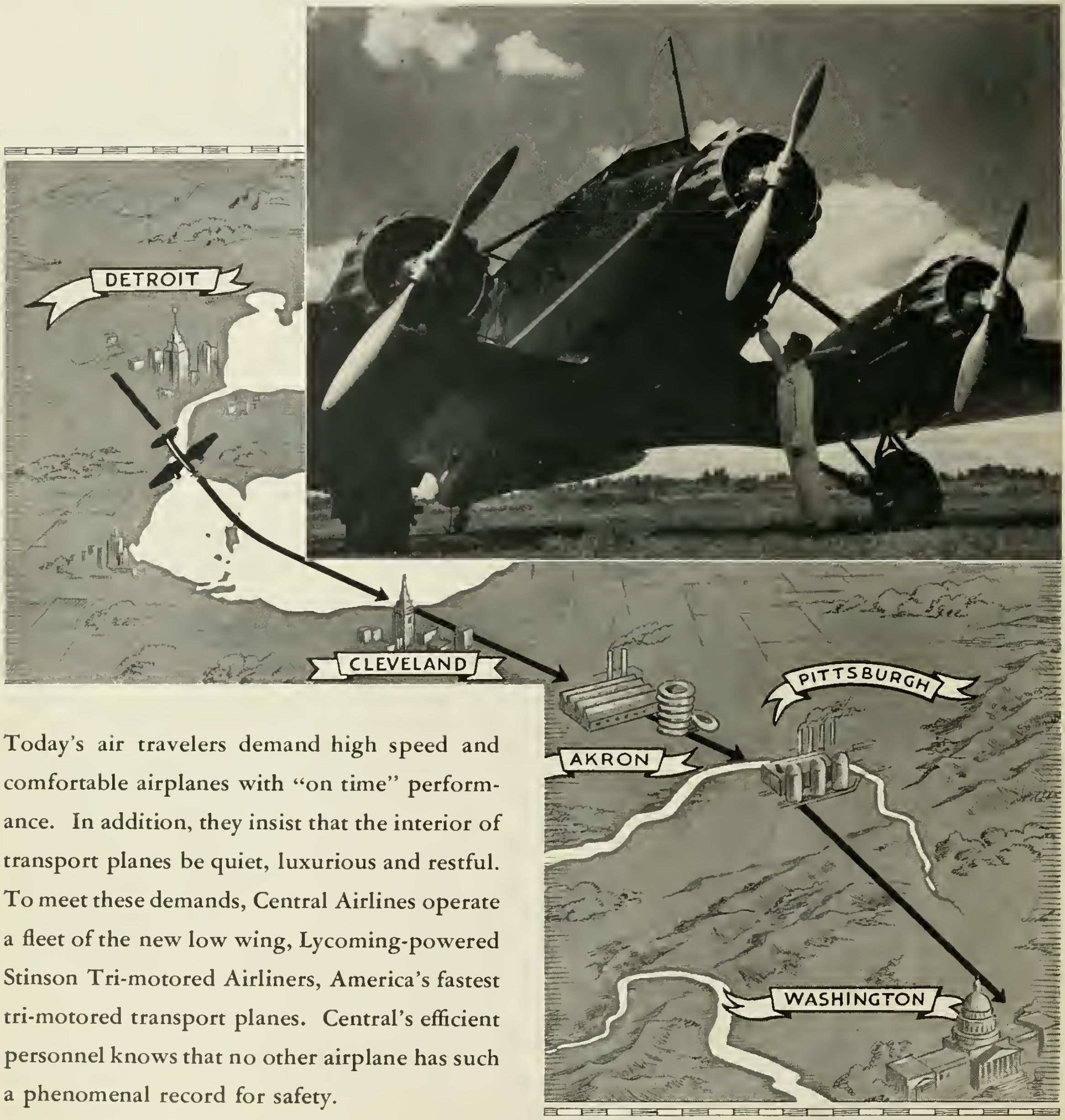

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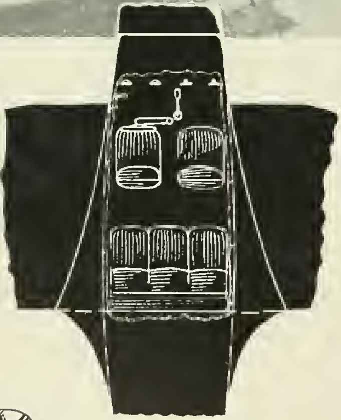

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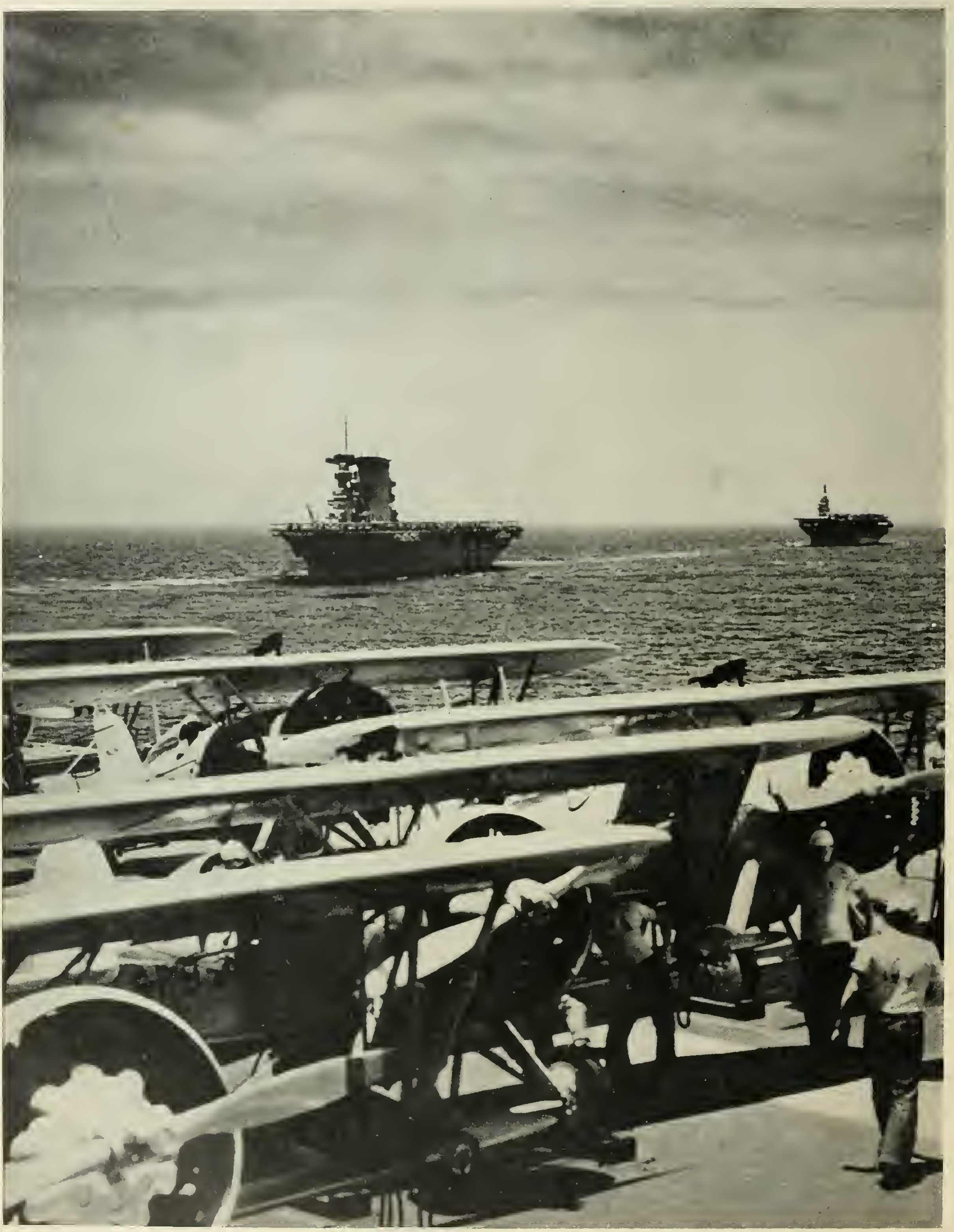


Acme photo

Nests in the sea. The United States Navy's Aircraft Carriers, U.S.S. "Lexington" (left) and U.S.S. "Ranger" as seen from the deck of the U.S.S. "Saratoga" during recent maneuvers in the Pacific Ocean

A FEW FALLACIES CONCERNING THE "CHEAP AIRPLANE" IDEA

●

WILLIAM B. STOUT

President, Society of Automotive Engineers, Inc.

● The first reaction of any unthinking man toward a modern automobile is that Mr. Ford and the rest have evolved a "cheap design," which, because of its cheapness, can be made for $700 or less.

Even more unthinking people than these look over an airplane and finding that it has fewer parts and less weight—whereas motor cars are built at so much per pound—immediately say "you should build this for $700, or less."

The fact of the matter is that no motor car today is a cheap design.

If it were nobody would buy it.

What Makes a Car Low-Priced

On its own merits, the so-called cheap car—which is really a low-priced car—is a better automobile than the high-priced heavy car. The reason is that the cheap car is built in large quantities, and by that I mean more than 1000 per day. This quantity makes the car low priced, though high in quality, remarkable in engineering, and luxurious in appointments.

Airplanes will be built equally as well and equally low-priced when they are made and sold in equal quantities per day. Under any other circumstances, broadcasting the statement that one can "build" a "cheap" airplane and sell it for $700 or anything near that price indicates a pathetic ignorance of the problem at hand.

Technical Problems

Technical problems never will be solved by other than technical men who know that 2 and 2 can never make 5. We do not make scientific laws in this world—we discover them. One cannot pass a law in Congress to make an engine run without spark plugs. We may discover a law, (and in fact have already done so) by which an engine can run without spark plugs. The law was not passed by any legislative body in order to make the Diesel engine run. Man's scientific mind and knowledge of his subject, together with millions of dollars spent in research finally attained the object.

If our friends in the Department of Commerce had a thousand airplanes today in a hangar where they were kept without having to pay rent and these airplanes had been presented to them free of charge to offer the public at $700 a piece, it would cost these learned and distinguished gentlemen more than $700 per plane to find a customer and sell the product on the dotted line. And the present regulations on private flying put on by that same department would restrict the sale of the first item it attempted to dispose of for $700.

A Matter of Judgment

More than that, the man who has such bad judgment as to fly a cheap contraption in the air—no instruments, no radio, no brakes, etc.—has not judgment enough to have earned $700 anyway. And if this cheap class of buyer of cheap intellect does get enough money to buy a cheap plane, he will do a cheap class of flying and eliminate a lot of cheap lives.

What this country can do, and should be encouraged to do, is to build the best possible completely-equipped private owner airplane that can possibly be turned out at any cost, and after that, start talking the banker angle of finance, which is not a very important matter anyway. You can sell a $20,000 two-engined, radio-equipped, automatic pilot, sound-proofed, private owner airplane to a customer who has the money to pay for it and to hire an experienced pilot who knows how to fly it, for no more sales cost (and perhaps less) than to sell a cheap airplane to an enthusiastic but financially embarrassed and irresponsible youngster who doesn't really know what it is all about.

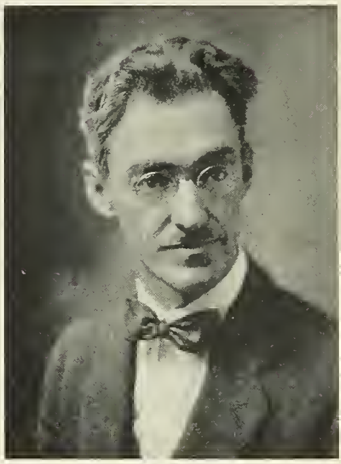
The successful foundation of all industry has been the production of a better, high-class, sound and finished product, and no business has ever been carried on to a satisfactory conclusion on a cheap basis; as visualize all bankers' attempts to run a business after it has been foreclosed.

There is a tremendous future for private flying eventually, but not on the present basis.

Auto Engines for Planes

Right now there is great talk in Washington of automobile engines being put into airplanes, and no doubt before long there will be a great hullabaloo about an airplane flying powered with an automobile engine. This will be called a great achievement for the master minds.

It must be remembered, however, that airplanes were flown 15 years ago with Model T Ford engines just as one might drive a 5-ton truck with a motorcycle engine and get a lot of publicity. But you don't notice that anyone ever goes anywhere or breaks any records, or does anything except fly a few times for the publicity value of the flight. Ships like that never could have reached the production stage.



William B. Stout

Can It Be Done?

An automobile engine as we know it today will never be made into an airplane engine, so cross that off your list. Very shortly, however, as the automobile man begins to get smart enough to know what has been going on in the airplane business he will start to build airplane engines for automobiles. And when Henry Ford or Walter Chrysler, or Mr. General Motors starts turning out these engines for a thousand motor cars per day and can sidetrack a few of them to be put into airplanes, then we may see a $200 engine for our private owner craft, but that will be in the day when the automobile industry has solved its problems, after the government has ceased to tell it how to run its own affairs.

Let me repeat again, automobile engines will never be used for practical aircraft of any type until aircraft engines become standard for automobiles.

I trust I make myself clear.

Boners of a Bureau Bungleer

●

CY CALDWELL

● The Bureau of Air Commerce is certainly in an awful mess, and there appears to be little difference of opinion on that score, even within the Bureau itself. That the Bureau in its present condition can work well for the advancement of aviation is much too much to hope for. It is suffering with dissension, strife and a conglomeration of half-baked undigestible ideas. What a belly-ache!

Colonel Harold E. Hartney, Technical Adviser to the U.S. Senate Subcommittee on Aircraft Investigation, asked me to present the Committee with some suggestions relating to the Bureau. Aware of my own limitations, and reluctant to condemn the sincere efforts of any man, I yet feel I should comply with his request.

To discover what is basically wrong with the Bureau, it is necessary to ponder the conditions that prevailed immediately after the election of President Roosevelt. There were in the country at that time possibly 103 hopeful aspirants for the office of Director of Air Commerce which was vacated by Col. Clarence M. Young because of the "spoils system." Of these let us consider only three: Rex Martin, onetime secretary to Representative Keller of Illinois; Major J. Carroll Cone, wartime pilot, good friend and campaign helper of Senator Robinson of Arkansas; and Eugene L. Vidal, West Pointer and former airline executive with Ludington Lines. Of these three, Major, (now Colonel) Cone undoubtedly would have been considered by the aviation industry as the most logical selection.

As for Mr. Vidal, the lucky appointee, I asked him at lunch recently in the presence of three of his head men, "How is it that you, a comparative newcomer in aviation, were made Director of Air Commerce?" He replied frankly that he was a friend of Elliott Roosevelt; that Elliott had taken him to Warm Springs for an interview with the President, and that his appointment apparently had resulted from that interview. So far as I can see, therefore, Mr. Vidal's chief qualification for the office rests in the fact that he knew young Roosevelt.

Probably for political reasons, the two unsuccessful contenders were given important positions in the Bureau. Martin was appointed Assistant Director in charge of the Air Navigation Division, and Cone was made Assistant Director in charge of the Air Regulation Division. Neither, of course, is quite happy in his job. That is natural and understandable.

My suggestion to the Senate Subcommittee on Aircraft Investigation is that it would be in the best interests of the aviation industry and of the people of the United States if all three of these gentlemen were to resign from the Bureau of Air Commerce. In making this serious suggestion I am not swayed by personal feelings; if I consulted only my feelings I would suggest that Cone be retained in his present position. But as all three are in some measure to blame for the present unharmonious condition, all of them should step aside in favor of someone who can co-ordinate the efforts of the Bureau. And in the future it might be well to abolish the two high-sounding titles of Assistant Director in Charge, and to substitute the accurate designation, Chief of Division.

The job needs an honest, sincere, unselfish man with a wide aviation experience, both military and commercial. What is more important is that our industry must have confidence in him as a sound, practical man—not a visionary. Vision is necessary, yet it must not be confused with the mere seeing of visions usually accompanied by the hearing of strange noises.

The present predicament of the Bureau of Air Commerce can be considered in no more serious light than the antics seen in a three-ring circus. I exclude, of course, the work of the Inspectors in the field, which on the whole is excellent. And that goes equally for the men of the Air Navigation Division. They are doing the best they can under peculiarly uncertain conditions. So in what follows, do not think that I am belittling the actual workers in the Bureau.

It is in the directorial end that the trouble lies; and one of the greatest sources of trouble is that the Bureau has become *publicity conscious*. The Bureau of Air Commerce evidently fears adverse publicity. Let me illustrate. I, a humble associate editor of a trade publication, go to Washington, make a few inquiries around and about, and let it be known that I have come for the express purpose of finding out what is wrong with the Bureau. I tell Fred Neely, Chief of the Information Section, that I never have agreed with the blatantly publicized experimental notions of his Chief, and that I would be glad to hear any explanations that gentleman might care to make.

If I were in the position of Director of Air Commerce and such a message was conveyed to me, I would say: "Send in that representative of the press. Inform him that I have exactly 8 minutes in which to listen to his remarks, and 4 minutes in which to answer them. Then I must leave him, and attend to my duties."

But what happened? I was invited to go to lunch with Mr. Vidal, Mr. Martin,

They talked everyone else out of the lunch room

Mr. Donald Bartlett, Chief of Administrative Section, and Mr. Neely. We had lunch in the Bureau; we talked during lunch; we talked after lunch; we talked everyone else out of the lunch room; we talked until the last waitress had cleared away the last table; then we adjourned to Mr. Vidal's office and talked until nearly the end of the afternoon. Except for what few minutes then remained of the business day, the Director of Air Commerce, the Assistant Director in Charge of Air Navigation Division, the Chief of the Administrative Section, and the Chief of the Aeronautic Information Section—four very important men—devoted their time and energies attempting to convince a reporter that the present small plane experiment was a worthy enterprise that would save aviation from itself!

Now, a different type of man than I might have felt highly flattered to have showered upon him such expensive attentions. But what I asked myself was: Why should these officials devote so much time to me? It cannot be that my conversation is so charming, for (believe it or not) I was so overawed by the flow of eloquent speech I had scarcely spoken; I had merely been spoken to, explained to, elucidated, educated, and told about this wonderful Development Section until they all finally talked themselves out.

The answer seems to be that these officials are apprehensive at the thought of adverse publicity.

And what of this small plane development, the crux of the whole situation? Vidal got a small airplane by the tail, and like the man with the bear's tail in his grasp, is afraid to let go. The future of the Bureau of Air Commerce under his direction is bound up in the fate of his $700 airplane experiment. Publicity has almost ruined him, although he has not been directly responsible for all of the publicity the experiment has received. Unfortunately for him, though, he started it, so he must accept the blame for it. But the $700 "all-mental" airplane must be a night-mare to him as it is to the industry. It has turned and bitten us all, and we will not be safe until it is laid low.

Vidal started off more than a year and a half ago with a great fanfare of publicity, calling attention to himself as the Moses who would lead the erring and backward children of aviation into a promised land of silk and money. He had come to save us with the $700 airplane. That was his Great Idea. He didn't know (or neglected to mention) that a cheap airplane built by mass production methods was one of our oldest and most wistful aviation hopes. A man named Henry Ford toyed with it away back in 1927, and had given it up for the time being. Dozens of manufacturers, building useful planes in numbers corresponding to their present potential markets, also had cherished the idea of building them by the thousands—some day. But they recognized that that day was not yet; and it still isn't, as even Mr. Vidal must realize by this time, for there isn't a single type in mass production, and no indication that there will be —for a long time.

Acme Photo

Shy, handsome Gene and his tailless machine

However, Vidal had spoken then, as he still speaks today, as though such a plane was parked just around the corner, like Prosperity. What is the result? Many who were considering the purchase of a small airplane decided to await delivery of the Vidal Masterpiece. True, the price has gone up slightly. Mr. Vidal himself now probably shudders when his first startling figures are mentioned. He protests that the $700 angle should be forgotten and forgiven; now he stresses the word "safe", and evades discussion of price. To call our attention even more forcibly to his "safe" airplane, he hints, nay, shouts, that all present airplanes are unsafe. He told me himself that our airplanes are growing more unsafe every year, because they are going faster; and the faster you go the harder you hit. This despite the fact that figures sent out by the Department show relatively fewer accidents per airplane than ever before. And in the face of lowered insurance rates brought about by safer flying conditions.

Now, after a year and a half what has Vidal produced? With $100,000 of tax money he has contracted for several interesting types of small plane. The first of these is the Hammond, and of it John H. Giesse, Chief of the Development Section, mournfully says in the July *Sportsman Pilot:* "The Hammond has flown and does not fulfill the expectations of the Bureau of Air Commerce and the contractor. It does not meet specifications with respect to speed and climb, and therefore the design has to go back to the drafting board accompanied by the test pilot's notes and comments." It was also accompanied by Lloyd Stearman (a competent well-known designer of airplanes which Vidal calls "unsafe") whom in desperation the Bureau has retained to try to do something with the Hammond.

Another contract was with Waldo Waterman of Santa Monica for a tailless airplane designed by him. The present yearning is all for tailless airplanes, so we may refer to this as the Tailless Period in aviation. The Waterman is a tailless pusher monoplane cabin type following the lines of the English Pterodactyl, which in turn follows a much older experiment—the tailless Burgess-Dunne, of about 1916.

The Weick is another interesting but odd-looking development, and so is the roadable wingless, direct-control autogiro being built by the Autogiro Co. There are also novel but over-publicized experiments being made to convert automobile engines for aircraft use, and belt drives connecting the engine and the propeller.

No doubt in the course of time some good will come from a few of these experiments. It is an excellent idea for the Federal Government to make available funds for experiment, and that money need not be considered wasted if only we learn that some of the ideas will not work out. Negative answers often are as useful as positive ones, if only to stop us from continuing in a wrong direction. But the most insidious part of this experimental program is the wild and unsupported publicity that has been attending it; and that is what everyone in the industry objects to. When Vidal bolsters his experiments by attacking all of our present types of planes as being unsafe for the private owner, which his own department proves they are not, he is committing a wrong against the very industry which his Bureau was formed to guide, and regulate.

Government support of aviation has been accorded primarily, not that Gracie Allen may fly swiftly from Hollywood to New York in a Douglas, or even that a

(*Continued on page* 71)

AIR

HOT AND OTHERWISE

By FRANK A. TICHENOR

● Life is cruel. Ask Farley, he knows. He's getting his nose rubbed in his own false righteousness. Life is a hard task master that way—it despises injustice parading under the banner of virtue.

A year and a half ago the Lord High Executioner of the Post Office Department committed one of the most unjust acts in American political history, the beheading of the air mail contractors. He excused himself by accusing the airline operators of collusion and corruption. He shouted to the housetops that the contracts had been awarded to the "big fellows" through pull when they should have gone to the lowest bidder. He sneered at the sound reply that the so-called big fellows got the contracts because they were the only ones equipped to carry the mails swiftly, reliably and efficiently. Utter rubbish, said he; why, anyone with an airplane could fly the mail—or words to that effect. The lowest bidder deserved the contract, and if he didn't get it, ex-Postmaster General Brown and the successful bidder were obviously crooked.

That was a year and a half ago. Today Big Yim Folly is caught in his own curses. For the Jobmaster General has called for bids on a trans-Pacific air mail route from San Francisco to Canton, China; and the jaws of practical logic are closing down on him to contradict every last word of his sophistries at the time of air mail cancellation.

Even an ignoramus knows there is one air transport company better fitted by experience and equipment than anyone else to fly the mails across the Pacific. It would be foolhardy—yes, ridiculous—to award the contract to any other operator. Slowly, surely, over a period of years that company has trained its personnel to master just such a job as this trans-Pacific contract calls for. It has invested large sums in providing its own radio aids to navigation, in creating servicing facilities on remote island stations, and in developing the finest over-water aircraft in all the world. As a result, it is prepared to convert into an actuality that age-old dream of aviation — reliable trans-oceanic air service on a regular schedule.

Now, won't Mr. Farley's face be red if some obscure operator with a fleet of seaplanes ostensibly meeting the requirements but not really capable of the job, enters a lower bid than this company? In that event, will he stick to his absurd rationalizations about deserving low bidders? Will he deliberately scrap America's supremacy in international air transport in order to save his face? No! You can bet your boots he won't. He dare not—and he knows it! The American public wouldn't stand for such stupidity. It would turn on him and massacre his political "career."

The situation here speaks so loudly that no one can mistake it, but essentially it is no different from that which faced ex-Postmaster General Brown. He simply had to choose between giving the country the best air transport possible or giving it the cheapest. He decided that America deserved nothing less than the best. As a result, the companies which had the greatest experience, the best trained personnel and the largest investments in ground facilities and aids to air navigation were awarded the contracts. As a further result, American lines, despite the handicap of many years head-start by other nations, had soon outstripped the others with the fastest, safest and most comfortable air passenger and mail service in the world.

Our present eminent Jobmaster General may soon find himself faced with the necessity of making a similar choice. It will not be any less embarrassing because he will have a committee of five other cabinet members to advise with in making that choice. For there can be only one choice. And in awarding the contract Farley will feel the sting of his own empty words boomeranging back at him.

* * *

This month begins the Senate investigation of the Bureau of Air Commerce report on the TWA accident near Atlanta, Mo. Whatever facts may be divulged on that subject, the investigation should not stop there. It should dig on to the very core of decay of the Bureau of Air Commerce itself.

Although the administration is apparently still blind to it, nothing has become so obvious to the aviation industry in recent months as that the Bureau of Air Commerce is no longer fit to perform its duties. Since those duties involve not only human lives, but also the progress of an industry destined to become one of the greatest in the national economy, something must be done and done soon to clean house in the Bureau and set things in order again.

The situation is far more serious than it may seem. For the Bureau has lost its most valuable asset—the confidence of the aviation industry. Without that, it can accomplish little or nothing. It degenerates into the bullying policeman instead of aviation's helping hand which it should be. It antagonizes where it should encourage. It creates confusion and turmoil where it should bring order and efficiency.

In order to understand how far the prestige of the Bureau of Air Commerce has fallen, look back just a couple of years. In those days the industry regarded the Aeronautics Branch as its big brother who could always be depended upon to succor it in time of distress or extend a firm helping hand in its steady climb of progress. The heads of the Department were sober-minded men who subordinated their own ambitions to the ambitions of the industry as a whole. Their attitude was reflected in the high morale of the Department's personnel in the field and shops. Everyone in aviation respected and admired them because they were conscientiously trying to do everything within their power to promote the best interests of aviation. It was almost sacrilege to utter a word of dissatisfaction with either the policies or methods of the Aeronautics Branch. In a word, aviation and the Department of Commerce in those lamented times were—to be trite but true—one big happy family, growing steadily in prestige and importance in the American industrial community.

What a pitiful contrast the spectacle of the Bureau of Air Commerce presents today! Nearly everyone—student pilots, private pilots, professional pilots, aircraft manufacturers, airline operators—all are clamoring at its door with complaints and grievances against it. Many of these complaints are thoroughly justified; others may not be. It matters not.

What does matter is that the Bureau has lost its grip, its prestige has sunk to an all-time low; its influence has evaporated almost to the last drop.

No government agency can perform its duties under such circumstances, and it is foolish to believe that the Bureau of Air Commerce can go on this way. The industry needs and wants the Government's cooperation. But cooperation is impossible without mutual confidence. Distrusting the motives and personal ambitions of the Bureau's high officials, the industry can have no confidence in the Bureau itself.

The only course which can save the situation, and restore the Department of Commerce to its rightful position of high respect, is a complete fumigation of the Bureau's executive offices and a healthful reorganization of the present eternal triangle of directors. The sooner we have such a renovation, the better for American civil aviation.

EDITORIALS

> "Although Wiley Post did not succeed in crossing the continent, through no fault of his own, stratosphere flying is not a fabled myth. When planes, capable of carrying passengers and cargo ten miles above the earth, sealed, built to withstand tremendous expansive forces, furnishing oxygen to passengers and crew without discomfort, built to keep occupants warm in external temperatures of —60° are completed, speeds now undreamed of will become actualities. The Atlantic will be crossed in the time it now takes to fly from New York to Chicago."—CAPT. IRA C. EAKER, U.S. Army Air Corps.

Flying Fortresses For Our Air Corps

● Bombers such as Boeing's new "flying fortress" are something new in our Army Air Corps circles. European powers have been developing multi-purpose bombing planes equipped with a most formidable array of armament and a crew disposed in strategic positions for offensive and defensive warfare. Until recently it appears to have been our policy to depend upon war planes limited in their functions.

The present tendency of our military authorities is to favor types of ships which will fulfill many missions, simultaneously. Thus, we see in the Boeing 299 with its four engines developing almost 3,000 horsepower, an advancement from the traditions of the conventional bomber which performed so remarkably in the past.

The world's fastest bomber which also has the longest range, will give this country proper representation in a classification in which we lagged. As soon as their worth has been demonstrated we should have sufficient numbers of them to bring our strength up to par in this important military category.

Abuses of Gasoline Taxation

● Late in October 1919, the state of Oregon originated and put into effect the first gasoline tax. Within a decade every state in the Union followed her example, and in 1932, the federal government took a hand in exacting tribute from the already overburdened taxpayer by imposing a motor-fuel tax of its own to provide revenue for general purposes.

Originally the fuel tax was a popular levy, since the income was being used in building and maintaining good roads. In effect, it was a service charge for the use of these roads, and was paid in direct proportion to that use. However, with taxation being the popular pastime at present, rates continued to increase, despite the fact that gasoline for years has been the lowest-priced commodity in general use. So that in 1934 the Federal Trade Commission found that "the combined rate of state and federal sales tax on gasoline . . . amounts to an average of about 5.14 cents per gallon and costs the consumers of gasoline approximately $700,000,000 a year." Not all of this tremendous sum is used for roads—much of it is diverted for other purposes, only a small part of which are aeronautical.

Since 1919, the average retail price of gasoline dropped from about 30c a gallon to about 12.5c a gallon in 1933. Taxes, however, for the same period rose from 1c to more than 5c on each gallon.

Fuel purchased for aircraft use is taxed exactly the same as that bought for motor car consumption. In some cases there are exemptions; in others, refunds are made if the pilot goes to the trouble of submitting proof of payment. The aircraft operator, however, receives no benefits from paying his tax, except in six states of the Union. None of the other tax money is used for airport construction and none of it is diverted for any aeronautical purpose.

Some logical and equitable solution should be arrived at so that the purchaser of aviation gasoline is considered when gasoline tax monies are being appropriated.

New Fields To Conquer

● Aeronautical men will watch with more than passing interest the progress of an unusual type of "composite" aircraft being built in England by Short Bros.

One of these strange flying machines is for Imperial Airways which obtained a government grant to foster its development. If everything goes according to schedule, trial flights of this craft will be made early next spring.

This type of construction, which appears to open up a new field of development, will consist of a four-engined flying boat which will ascend with an "upper component"—a four-engined seaplane—on its wings. At the required operational height, and when moving at a predetermined airspeed, the upper component will be released from its bearer and continue flight independently under its own power.

Apart from its potential value in making possible the operation of long non-stop planes carrying heavy commercial loads (particularly across oceans) the idea has obvious military interest.

Experiments of this nature hold possibilities in innumerable outlets little dreamed of but a few years ago.

A Tribute to Three Pioneers

● With the passing last month of three of its pioneers, the industry faces the future minus the physical encouragement, moral assistance and guiding genius of men it would have liked to keep with it forever.

In the Honorable Frank H. Hitchcock it had one of its oldest enthusiasts and staunchest boosters—one who, in 1911, had the foresight to vision the possibilities of the airplane as a most efficient carrier of mail.

Risking ridicule and realizing the risk entailed by operating the frail equipment of that day, he inaugurated the first aerial transportation of mail, then continued to participate in the steady progress of the system that grew out of his early experiments, and fortunately lived to see it reach heights yet to be equaled anywhere else in the world.

His record was one of unselfish public service which stands out in bold relief compared to that of the present incumbent of the office Mr. Hitchcock filled so successfully and served so honorably. The firm root he planted twenty-four years ago will survive and grow to greater achievements—a perpetual and useful testimonial to the Father of Air Mail.

The loss of Wiley Post and Will Rogers was sudden and shocking. Both were part of our present system, universally beloved and respected. Adventurous men, matured in the experiences of the world, and fully aware of what might be ahead, they braved the dangers of little known areas in a combined vacation and good-will effort intended to bring closer the peoples of Alaska, Siberia, Russia and the United States.

The public's immediate reaction to the disaster was an unmistakable manifestation of its acceptance of the airplane as a safe and dependable vehicle of transportation. All the airlines reported increased bookings. There were no cancellations of passage, extra sections had to be added to many scheduled trips, and some transcontinental bookings had to be made a full week ahead!

It was the regrettable passing of two of the industry's outstanding sons that supplied this evidence of the public's air-mindedness. Wiley and Will would have wished for no greater tribute.

Personairlities

by Caldwell

● OUR PECULIAR civilization is so constituted that if a man consistently makes a pest of himself the world hears of him. If he merely devotes his energies to making life better and easier for us he may remain almost unknown. Everyone, for instance, has heard of the three radio comics, Johnson, Coughlin, and Long in their amusing presentations of blither, blather, and bosh; but few outside of the rubber industry have heard of John R. Gammeter. While the three noise-producing growths I mention have done nothing for humanity but vibrate microphones with their clamor, John Gammeter went quietly to work and invented the vacuum box method of forming tires by building them flat and shaping them by vacuum or internal pressure. This process eliminated making tires on a core, thus bringing the manufacturing cost down and saving the tire industry and the consumer millions of dollars a year. It is probably the greatest invention in rubber since Charles Goodyear discovered the process for the vulcanization of rubber.

Curious to see what honor the world would confer on such a benefactor, I looked John Gammeter up in the *Encyclopaedia Britannica.* John hasn't made the grade. But Barnabe Googe has. Googe, I learn, was "an English poet who in 1563 became a gentleman pensioner to Queen Elizabeth." John Gammeter never perpetrated a poem or panhandled a pension from Queen Elizabeth or anyone else, so the *Encyc. Britt.* knows him not. It lists Charles Goodyear, though, but gives him only a paragraph, while it devotes a whole page and a paragraph to *Ribes Grossularia,* the common gooseberry! There's justice for you: the man whose genius for invention enabled the world to ride on rubber is accorded less than 20% of the space given to a humble gooseberry! Even Gooty, a town and hill fortress of southern India, and Gopher, a burrowing, squirrel-like rodent (who bears a strong facial resemblance to Will Hays) are given a paragraph, like Charles Goodyear, leaving to me the task of calling the world's attention to John Gammeter. Encyclopaedias, I sometimes think, are edited by idiots for fools to consult. Glance through any of them and you will be amazed at the space they accord poets, playwrights, novelists, historians, politicians, kings, queens, and princes, while to useful humans who have really done something to ease the burden of life for all of us they give only casual mention. The reason is that encyclopaedias are written by writers, puny fellows who eke out an existence by setting down one little word after another, with an occasional idea to make the mess tolerable. So they admire other puny writers and honor them with profuse attention, for all of us tend to admire the human atom most like our puerile selves. Inventors should edit an Encyclopaedia of their own, giving poets a line each.

John R. Gammeter has obtained U.S. patents on more inventions than any other man in the United States. A few of the more important are: A machine for winding the first rubber thread golf ball ever made, in 1900; original method of making garden hose in continuous length; original V-shaped fan belt for automobiles; original hard rubber battery container and the machinery for making it; first successful cord tire, made in 1909; volumetric press for blanking out rubber heels, and automatic mold for filling devise for same; automatic making of cord fabric bands for shoulder built flat tires; variable pitch propeller for airplanes and dirigibles; automatic gas valve for dirigibles, developed during the war and now standard equipment on Navy, Army, and commercial airships; original machine for making continuous lengths of tubing for rubber bands, inner tubes, and the like; Tru-Lay Preformed Wire Rope used for heavy duty service, and many other inventions. He is now working on a device to automatically and painlessly remove the pants from six-foot passengers in Pullman upper berths—this will be his crowning invention and a boon to Shorty Schroeder, who has never been able to remove more than his tie in an upper.

With the technical schools of our land turning out mechanical geniuses and chemists by the thousand, and with our ears defeaned by the shouts of the educationists that without a college education you'll never get anywhere, it is refreshing to note that John Gammeter, from whose inventions millions have been made, was educated in the Akron grade

Gammeter, inventor of the one-wheel trailer and 1000 other devices

schools only as far as the 7th grade. (I got a poorer start than he did—I graduated from the 8th. If I had quit at the 7th I might have got somewhere.) John Gammeter was born in Akron on March 27, 1876. His father died when John was ten years old; and his mother, with a family of five boys and three girls, had a hard struggle to make ends meet, so the boy went to work and spent three years learning to be a plumber. But as bathtubs were still used to keep coal in there was little work and nobody wanted John as a plumber. The only job he could find was pushing a wheelbarrow in the B. F. Goodrich Company's Akron rubber plant at 10 cents an hour—those were the days of rugged individualism, when the employers always turned out to be more rugged than the employees.

His First Invention

While pushing his wheelbarrow one day he noticed a number of girls using knives and shears to trim rubber stoppers for bottles, slow laborious work. So he borrowed a few of the rubber stoppers, and in a junk metal heap found some parts and devised a machine that would trim hundreds of rubber stoppers an hour. His pay was raised to 17½ cents an hour, and his employers "accepted" the machine and fired the girls. This comes under the head of Progress. Next he worked out an idea for a machine to make bicycle tubes, which girls had been making by hand, slowly and expensviely—some of them were paid 10 cents an hour. Again his machine was "accepted" by a grateful employer, and the girls didn't have to work hard any more. In fact, they didn't have to work at all, for they were fired, too; and the President in his annual report to stockholders said that if John could only keep on going that they'd be able to fire everybody in time, even the President. Everyone was delighted, except possibly the people who had been fired. No, I'm not being cynical. That really is Progress. The sooner our bright minds can invent machines to do all of the world's dull, soul-deadening work, and fire everybody who has been doing it, the better it will be for civilization. *Only*—and this is the part that has been neglected—when we fire the people we must make some provision for their support. We'll do that when our system of Social Blundering catches up to our Mechanical Sciences—if it ever does.

Determined to learn how to make his own drawings, Gammeter went to night school to study drafting and also took a second-hand I.C.S. course, which he says he still uses as a reference work. He was then, at the age of 22, permitted to devote his time to inventing labor-saving devices, as they are humorously called. Nobody paused to ask labor how it liked being saved by being fired. It's a mad world, my friends. Right now the publisher of Aero Digest is working frantically on a device to fill these columns by pouring a bottle of ink into a machine instead of pouring a bottle of Hiram Walker's Rye into me.

Less than five years after the Wright Brothers made their first airplane flight, John Gammeter became interested in aviation. In a magazine he saw a drawing of a French plane designed by Santos-Dumont, so he built one like it and powered it with a 2-cylinder air-cooled engine rated at 16 h.p. when it was feeling good, which it seldom was, for it soon would heat up and stop. John would get up at four in the morning and run the plane up and down Portage Path, one of Akron's residential streets, testing the engine. It always stopped in five minutes. He could depend on that. He made a few trial flights over the golf course of the Country Club, but was finally ordered off because he had to land every five minutes, and every time he landed he tore up the grass. So he bought 80 acres of land near Silver lake and built the first landing field near Akron. He flew for three years and gradually learned to fly. Now he flies only as a passenger.

On the day that he was fifty years old, nine years ago, he resigned from the company for which he had worked for thirty years and for which he had invented more than 250 patented devices—he finally worked up to a point where he got paid for them!—and retired to his estate to engage in laboratory work and to act as consultant for about a dozen large industrial concerns. He has chemists and engineers who help him in his problems on details; but he's the Kingfish who thinks up the inventions he wants. One of his actual inventions, that would do credit to Rube Goldberg, is the squirtless non-skid hot-dog. His machine tunnels a hole in the bun, toasts the bun and the weiner, and then shoves the hot doggie in his kennel, with mustard.

Off For a Good Time

He enjoys himself most when he dons an old coat, takes his gun, and loads several of his hunting dogs in a crate that he carries on a special trailer attached to one of his cars, and sets off for the woods. Even the trailer travels on a single swivelling wheel equipped with a streamline Jumbo, Jr. tire. Gammeter is now at work on a dog-saving invention: a mechanical bird-detector. When he gets it perfected he will be able to fire the hunting dogs, thus putting civilization ahead another inch on the road of Progress. If he gets time he'll also patent what he considers his final invention—an automatic mechanical heat-regulated coffin for worn-out inventors. It rolls unerringly to the cemetery, lowers itself into the grave, hoots once derisively, and pulls dirt in on top of itself.

* * *

● NO, YOU are wrong! This is not a snap shot of Public Enemy No. 1 just after the sheriff sprung the trap. In the first place, the image is not that of a notorious, hardened criminal. Now, don't argue with me. I realize what it *looks* like, but I *know* the guy. He's a personairlity.

In the next place, he hasn't been hanged. Again, please don't raise your eyebrows. I'm not theorizing about what might have been; I'm stating facts. The fellow is asleep. Just plain, ordinary slumber from which, alas, he will awake.

"—not arguing, not talking—"

Since your speculations are so misconceived, I'll tell you who he is. It's none other than our one and only Cy! Can you believe me? The irrepressible Cy Caldwell—not arguing, not talking, not even dragging on that omnipotent and all permeating pipe—but tranquil, quiet, sleeping!

The powerful anesthetic causing such a phenomenon was the previous night of entertainment in Montreal. Cy was a member of the Fourth Annual Roosevelt Field—Montreal International Goodwill Flight. The scene is in a Roosevelt Flying Corp. Fairchild cabin plane, high over the undulating green hills of Vermont. Lovely Champlain spread its crystal clear waters to the right, against a background of impressive beauty, as the mighty Adirondacks fill the western horizon. To the left, the East is a panorama of pastoral charm, crested by the beauty of the Green mountains. But did Cy revel in this setting of nature's grandeur, did his artistic spirit rise to such esthetic inspiration? Alas, no. Just sleep—prosaic, peaceful, precious sleep.

So, let this be a lesson to you. Appearances are often misleading. Cy is not as bad as he appears in this moment of rapturous abandon—not quite!

—George W. Orr.

DR. ALEXANDER KLEMIN
GLENN D. ANGLE

AVIATION ENGINEERING

DR. MICHAEL WATTER
DR. MAX M. MUNK

SELECTION OF PROPELLERS

and calculation of power available and thrust for various flight conditions

●

ARMAND J. THIEBLOT

A comparatively simple method is given here for the determination of propeller diameter and blade setting, with airplane aerodynamic characteristics and conditions of operation of the engine, such as boost pressure, r.p.m. and altitude assumed to be given. In this method, contrary to the usual procedure, the speed of the airplane is considered as an unknown quantity and is determined, together with the propeller itself, from the conditions of operation of the engine and from the lift and drag coefficients of the airplane. A procedure is also given for the calculation of the available power and thrust, starting from the known characteristics of the selected propeller.*

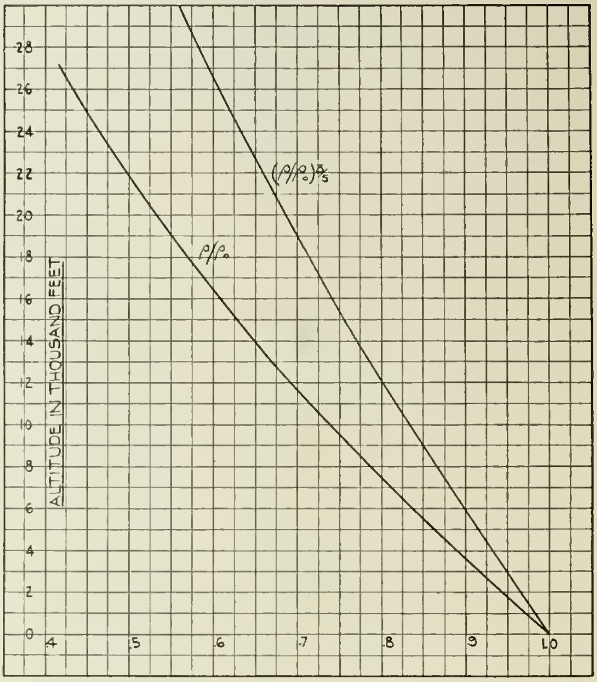
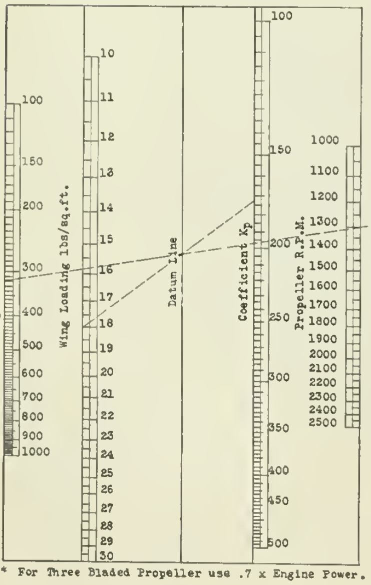


Figure 2. Chart for altitude factors



* For Three Bladed Propeller use .7 x Engine Power.

Figure 1. Chart for determination of Kp

● The progress realized recently in propeller design, the adoption of superchargers, boost and mixture control on engines and the more accurate data furnished by engine manufacturers, justify greater precision in the choice of the propeller and in the performance calculation of the airplane.

Of the various types of propellers now in use, only the controllable pitch and constant r.p.m. need be considered. The other types constitute particular cases for which similar calculations apply. The above mentioned propellers can be used in connection either with unsupercharged, supercharged or engines fitted with automatic boost and mixture control.

The propeller is generally determined to give the best performance at boost pressure and r.p.m. corresponding to the minimum specific fuel consumption. However, it may be desired to adapt the propeller for high speed, best take-off or best rate of climb, etc. The method outlined below applies to all these various cases except take-off which is discussed later. The example chosen to illustrate the method considers the adaptation of propeller for cruising speed.

In an example of the adaptation for best performance at the rated altitude, the engine is assumed to be supercharged, geared and fitted with a three-bladed propeller, and the determination of the propeller diameter is the same for a controllable propeller with two pitch settings or for a constant r.p.m. propeller.

Airplane characteristics: wing area, 500 sq. ft.; gross weight, 9000 lbs.; wing loading, 18 lbs./sq. ft.;

C_L and C_D for the complete airplane are given in Table I.

Engine characteristics (Hornet S2EG): rated altitude, 2500 ft.; gearing, 3:2; max. power at rated altitude, 755 h.p. at 2250 r.p.m. with 35" Hg. boost pressure; max. power for take-off at sea level, 755 h.p. at 2250 r.p.m. with 35.5 Hg. boost pressure; recommended for cruising, 25.5" Hg. boost pressure at 1950 r.p.m.; operating altitude of the airplane, 5000 ft.

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* Propeller data taken from N.A.C.A., Report 481, *Working Chart for the Determination of Propeller Thrust at Various Speeds. (Cabin Fuselage with Completely Cowled J-5 Engine.)*

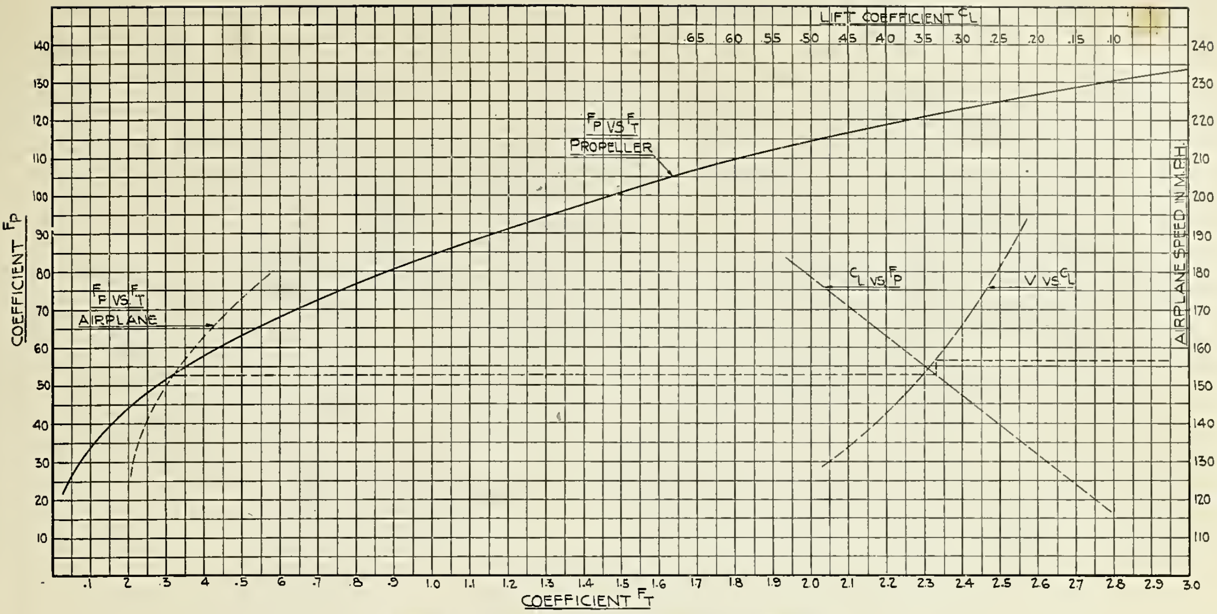

Figure 3. Airplane speed and adaptation coefficient

From the engine curve; at 5000 ft., 25.5" Hg. boost pressure and 1950 r.p.m. (propeller 1300 r.p.m.) we find 455 b.h.p.

The calculations are carried in Table I:

Table I

C_L (1)	C_D (2)	F_p (3)	F_T (4)	V (5)
.25	.035	39.4	.24	181
.30	.0342	47.25	.282	165
.35	.035	55.10	.336	153
.40	.037	63	.406	143
.45	.039	70.9	.482	136
.50	.0415	78.8	.568	128

Column 1 indicates the airplane lift coefficient; column 2 the airplane drag coefficient at C_L corresponding to column 1.

F_p of column 3 is computed as follows:

$F_p = K_p\,(\rho/\rho_o)^{3/5}\,C_L$, where

K_p is taken from figure 1, and

$(\rho/\rho_o)^{3/5}$ is taken from figure 2.

For the above example

$F_p = 172 \times .915 \times C_L$

F_T of column 4 is computed as follows:

$F_T = K_T\,\rho/\rho_o\,C_L\,C_D$

$$K_T = \frac{S\,(N/1000)^2}{W/S} \cdot \frac{a}{n}$$

where

N = propeller r.p.m.

S = wing area

a = numerical coefficient equal to 1 for two bladed propeller and .679 for a three bladed propeller

n = number of engines

For the above example:

$$K_T = \frac{500 \times 1.3^2}{18} \times .679 = 31.9$$

$F_T = 31.9 \times .861 \times C_L \times C_D$

V of column 5 is computed corresponding to C_L of column 1.

$$V = \left[\frac{W/S}{.002558 \times \rho/\rho_o}\right]^{\frac{1}{2}} \quad [1/C_L]^{\frac{1}{2}}$$

For the above example:

$V = [18/.002558 \times .861]^{\frac{1}{2}}\,[1/C_L]^{\frac{1}{2}}$

On chart (figure 3) plot F_T against F_p marking intersection on curve. Plot on the corresponding scale V against C_L, and F_p against C_L. Draw a line parallel to F_T scale from intersection to the line $C_L — F_p$, from the new intersection draw a line parallel to F_p, scale to speed curve (curve $C_L — V$), and read the speed on the speed scale.

From the above example, we have, (figure 3)

$V = 156.5$

$F_p = 52.5$

On figure 4, at the intersection of $F_p = 52.5$ and the maximum efficiency line we read V/ND and the blade angle as indicated.

We have: $V/ND = .91$ and blade angle = 22° at 3/4 R.

The propeller diameter is then given by:

$D = 88\ V/N\,\gamma$ with $\gamma = V/ND$

$$\text{therefore } D = \frac{88 \times 156.6}{1300 \times .91} = 11.65 \text{ ft.}$$

The result of the adaptation is then:

Cruising speed at 5000 ft. with 25.5" Hg. boost pressure and 1950 r.p.m. = 156.5 m.p.h.; Propeller diameter = 11.65 ft.; Blade angle = 22° at 3/4 R.

It is to be noted that on figure 4, the maximum efficiency line represents the locus of the maximum efficiency of each individual propeller; making the intersection of a constant F_p line with the family of curves, we find an infinite number of blade settings and V/ND values for which the absorbed power is constant. However, all the curves below the maximum efficiency line (dotted lines) do not satisfy the thrust equation and therefore cannot be considered. The curves above the maximum efficiency line answer the problem. In the case of the above example we could have chosen $V/ND = 0.95$ and blade angle 24°. The corresponding propeller would have been 11.13 ft. dia. The efficiency under the conditions at which this propeller operates is of course the same, but for the 11.65 ft. this value of the efficiency is maximum, while the maximum of the 11.13 ft. propeller is larger and occurs at a larger value of V/ND. We are therefore at liberty to choose any propeller from the maximum efficiency line up. The propeller chosen (as above) on the maximum efficiency line is the largest propeller compatible with the conditions of adaptation.

Adaptation for Take-Off

The procedure outlined above cannot be used for the adaptation at take-off, due to the fact that the equality between thrust and drag no longer exists. This equation is replaced by a condition of maximum thrust. Since the shape of the maximum efficiency line for low values of V/ND is not well defined, it is necessary to resort to a trial and error method. Because the efficiency varies very rapidly with V/ND and since the optimum propeller for take-off generally has a larger diameter than would be required for the flight condition, it is only necessary to compute the thrust at take-off for the propeller already determined, make another trial with a propeller of say, ½ ft. larger, and compare the results.

For the selection of the diameter the above procedure holds true for the two types of propellers under consideration. But for the two-pitch controllable propeller another compromise must be made between the pitch setting for maximum thrust at take-off and the setting corresponding to maximum efficiency at climbing speed since only one setting is available for both conditions.

The procedure for determining the thrust is exactly the same as for the calculations of available power which are described later.

Low Pitch Setting

Assume that the compromise between take-off and climb indicate, in the case of our example, the propeller efficiency should be maximum at 110 m.p.h. at sea level and that there is no advantage in changing the diameter which will be taken equal to 11.5 ft.

Compute the power coefficient by the formulae:

$$C_p = \frac{P \times 550}{N_s^3 D^5 \times .002378\ \rho/\rho_0}$$

where

P = engine power for climb and take-off

N_s = revolutions per second (propeller)

ρ/ρ_0 = altitude coefficients (density ratio)

In the case of three bladed propeller, P should be multiplied by .7.

We have:

$$C_p = \frac{.7 \times 550 \times 755}{11.5^5 \times 25^3 \times .002378} = .038$$

From the engine curve, maximum pressure for climb and take-off = 35.5" Hg. or 755 h.p. at 2250 r.p.m. or 3/2 × 2250 = 1500 propeller r.p.m.

$$V/ND = \frac{88 \times 110}{1500 \times 11.5} = .561$$

The blade angle can be obtained from figure 5, at the intersection of C_p and the interpolated value of V/ND. In this case the blade angle at 3/4 R would be 17.6°.

The blade angle can be determined more accurately by making a table of values of V/ND higher and lower than the calculated and computing the r.p.m. required to absorb the engine power. A curve may then be drawn showing the variation of r.p.m. against blade angle. The intersection of this curve with the engine r.p.m. gives the corresponding blade angle.

Computation of Available Power

The power available is computed from the propeller data given in figures 5 and 6. The procedure is given for the two types of propellers under consideration.

As determined previously the known quantities of the controllable 2-pitch setting propeller are: propeller diameter; pitch setting; and engine power in function of boost pressure, r.p.m. and altitude.

The problem consists of determining for each speed, the engine r.p.m., and the propeller efficiency.

The relation between power, r.p.m., boost and altitude is given on the engine chart; if the boost is limited or the engine fitted with an automatic boost and mixture control, the power corresponding to various r.p.m. should be read on line of constant boost, up to the altitude for which this particular value of the boost corresponds to a full throttle condition. Beyond this altitude the engine should be considered as working at full throttle.

Tabulate from the engine curve, r.p.m., power, and boost at the various altitudes for which the available power is desired as indicated in Table II for the example treated herewith.

In this case the critical altitude for 25.5 boost is 13,400 ft.

Power available for constant boost or full throttle condition is calculated as indicated in Table III, in which column 1 lists the values of r.p.m. considered in Table II.

The propeller r.p.s. in column 2 for this example is computed:

r.p.s. = r.p.m. 2/3 × 60

Column 3 lists the engine power from Table II, and C_p of column 4 is computed as indicated previously.

For three bladed propellers P should be multiplied by .7.

$$C_p = \frac{550 \times .7}{11.5^5 \times .002378 \times .861} \cdot P/N_s^3 = .935\ P/N_s^3$$

From figure 7, determine V/ND (column 5) corresponding to the blade setting and the value of C_p of column 4.

V of column 6 is computed by the formula

$V = N_s D/1.466$

From figure 6 determine the propeller efficiency (column 7) corresponding to the blade angle and the values of V/ND

(*Continued on following page*)

Table II

Altitude Manifold Pressure RPM	Max. for Take-off 35.5	Sea Level 25.5	5000 ft. 25.5	10000 ft. 25.5	15000 ft Variable with RPM
	Brake Horsepower				
2250	755	490	520	555	480
2150	730	470	500	535	455
2050	705	450	482	515	430
1950	675	425	455	490	410
1850	645	395	430	460	385

Table III

Computation of Power Available at 5000 ft.
Boost Limited to 25.5" Hg. Blade Setting 22°.

Engine RMP (1)	Prop. RPS (2)	P Engine HP (3)	C_p (4)	$\gamma = V/ND$ (5)	V (6)	η (7)	THP (8)
2250	25	520	.0311	1.015	199	.81	408
2150	23.9	500	.0344	.98	184	.825	400
2050	22.8	482	.0382	.93	166	.84	393
1950	21.65	455	.0430	.88	150	.84	371
1850	20.55	430	.0462	.820	132	.83	346

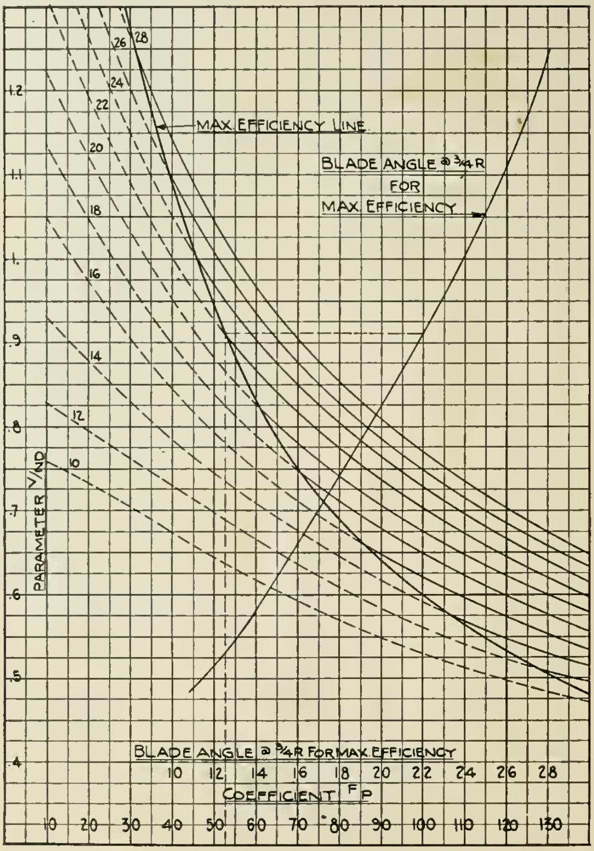

Figure 4. Chart for determination of propeller diameter and blade angle at ¾ radius

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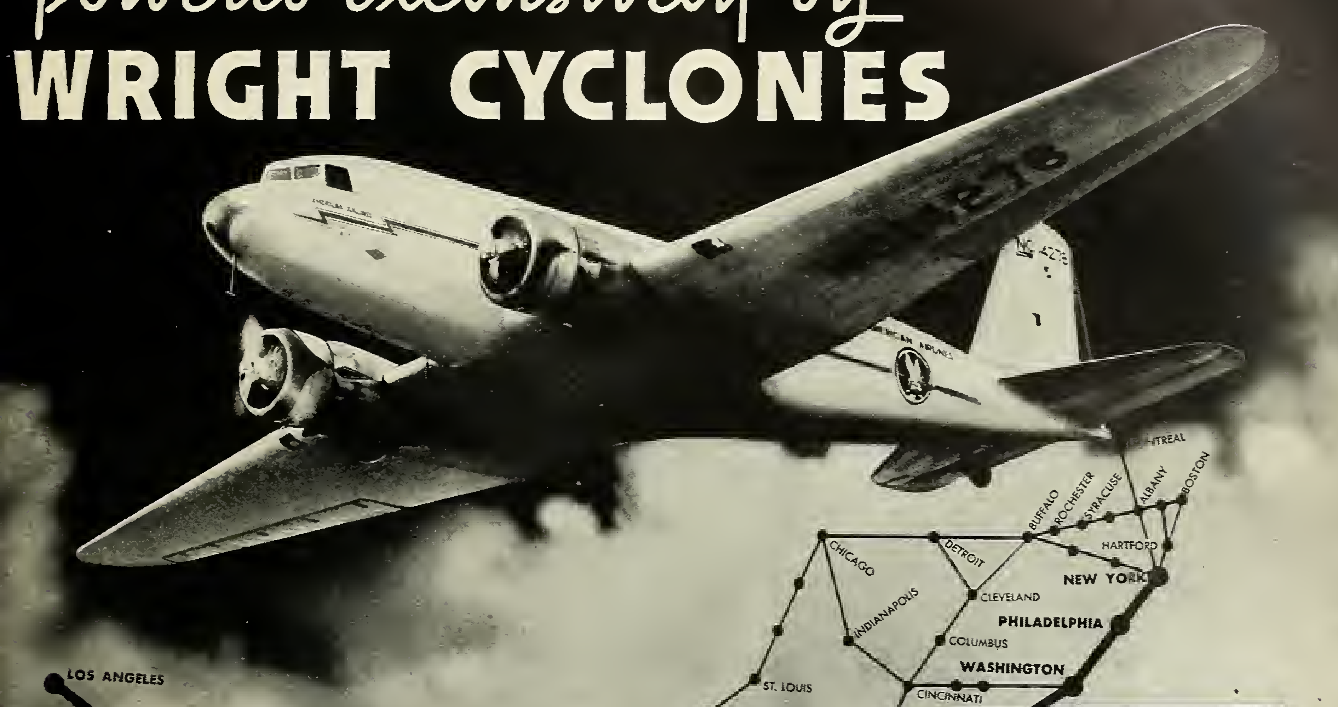

Interior of Cyclone-powered Douglas Airliner Day Plane

Interior of Cyclone-powered Curtiss-Wright Condor Sleeper Plane

merican Airlines "Southern Transconti- ental" planes are powered exclusively by right Cyclone Engines.

The "Southern Transcontinental" pro- des fast, luxurious transportation—from ew York, Philadelphia and Washington a Tennessee, Texas and Arizona—to Los ngeles and the California-Pacific Inter- tional Exposition now in full swing at n Diego.

The day flight is made in the new 14- ssenger Douglas Airliners powered by vo Wright Cyclones. The comfortable mchairs and luxurious appointments of this famous 210 m.p.h. Airliner provide the quiet atmosphere of an exclusive club.

The night flight is made in deluxe Curtiss-Wright Condor Sleeper Planes, also powered by two Wright Cyclones. The soundproofed cabin of this Airliner and the extra long berths enable complete relaxation and restful sleep.

American Airlines' transports fly nearly 38,000 miles daily in 22 states and provide direct service to 57 principal American cities. All of the airplanes flown over the main divisions of this great air transportation system are powered by Wright Cyclones.

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(*Continued from preceding page*)

of column 6. Greater precision could be obtained with a chart of efficiency against V/ND for various blade angles. This chart could readily be drawn from the data given in NACA report #481.

Compute available power of column 8 multiplying values of column 3 by corresponding values of column 7. For three bladed propeller multiply above product by 0.97.

If the engine r.p.m. is limited to a certain value which cannot be exceeded, the power available for throttled condition is computed as indicated. Table IV assumes engine r.p.m. maximum to be 1950, blade setting 22°, and the altitude 5000 ft.

Table IV

V/ND (1)	V (2)	C_p (3)	η (4)	THP (5)
.8	136	.048	.825	416
.9	153	.041	.845	364
1.	170	.032	.815	274
1.1	187	.023	.72	174

V/ND in column 1 is arbitrarily chosen.

V of column 2 is computed by

$$V = \gamma \frac{ND}{88}$$

$$V = \frac{1950 \times 2 \times 11.5}{3 \times 88} \gamma = 170\,\gamma$$

From figure 7 determine C_p (column 3) corresponding to the blade setting and the value of V/ND of column 1.

From figure 6 determine the efficiency (column 4) corresponding to the blade setting and the value of V/ND of column 1.

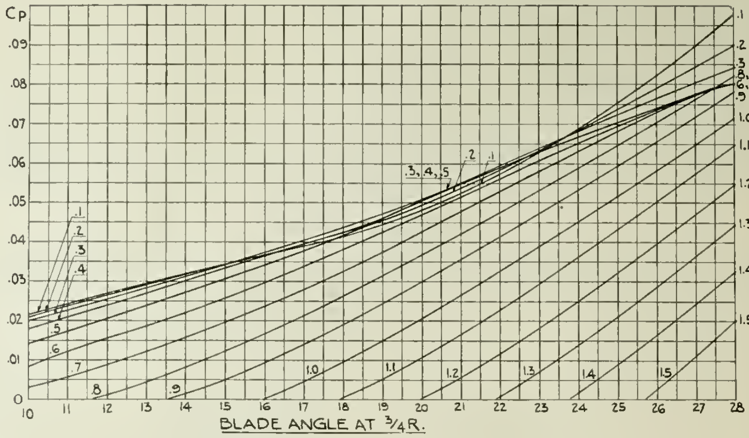
Compute available power (column 5) by the formula

$$P = \frac{C_p\, N_s^3\, D^5 \times .002378 \times \rho/\rho_o}{550} \cdot \eta$$

For a three bladed propeller, P should be multiplied by .97/.7.

$$P = \frac{11.5^5 \times 21.65^3 \times .002378 \times .861 \times .97\, C_p}{.7 \times 550}\, \eta$$

$$P = 10500\, C_p\, \eta$$



Figue 5. Cross plot of Cp vs. blade angle

For a constant r.p.m. propeller, the power available is computed as indicated in Table V, in which the propeller r.p.s. is 21.65, and the altitude 5000 ft.

For this example boost, and r.p.m. are taken constant with the values of 25.5" Hg., and 1950, respectively.

Table V

V/ND (1)	V (2)	β (3)	η (4)	THP (5)
.7	119	20	.815	360
.8	136	21.1	.83	366
.9	153	22.3	.845	373
1.	170	23.7	.85	375
1.1	187	25	.85	375

List arbitrarily values of V/ND (column 1).

Compute V of column 2 by

$$V = \frac{N_s D\, \gamma}{1.466} = \frac{11.5 \times 21.65}{1.466} \gamma = 170\,\gamma$$

Compute C_p (column 3) by the formula

$$C_p = \frac{550\, P}{N^3 D^5 \times .002378 \times \rho/\rho_o}$$

For a three bladed propeller, the engine power should be multiplied by .7.

$$C_p = \frac{550 \times 455 \times .7}{21.65^3 \times 11.5^5 \times .002378 \times .861} = .0430$$

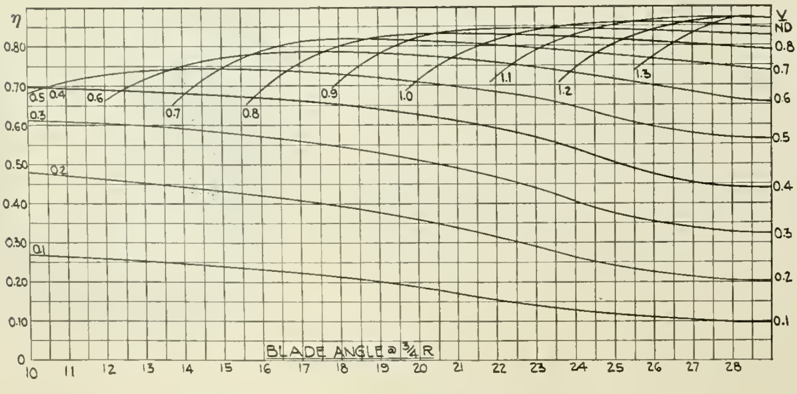


Figure 6. Cross plot of propeller efficiency vs. blade angle

From figure 5, determine the blade angle corresponding to the above value of C_p and the values of V/ND of column 1.

From figure 6 determine the propeller efficiency (column 4) corresponding to the blade angle listed in column 3, and the value of V/ND of column 1.

The available power (column 5) is given by the product of the engine power corresponding to given boost and r.p.m. and the propeller efficiency listed in column 4. For a three bladed propeller, η should be multiplied by 0.97.

The thrust is readily obtained from the available power and for the thrust at take-off it is only necessary to start the tables with lower values of V/ND.

Appendix

Derivation of the general formulae of propeller adaptation.

The power absorbed by the propeller is given by

$$P = C_p\, \rho\, N^3 D^5$$

The thrust delivered by the propeller is given by

$$T = C_p\, \rho\, N^2 D^4$$

Let γ be the parameter V/ND

Eliminating D between the above equation and the expression of the parameter we have:

$$P = \frac{C_p}{\gamma^5}\, \rho \frac{V^5}{N^2} \dots\dots\dots\dots\dots\dots (1)$$

$$T = \frac{C_T}{\gamma^4}\, \rho \frac{V^4}{N^2} \dots\dots\dots\dots\dots\dots (2)$$

Speed and thrust must satisfy the following equation:

$$W = C_L\, \rho/2\, SV^2,$$

$$\text{or } V^2 = \frac{W}{C_L[\rho/2]S} \dots\dots\dots\dots\dots (3)$$

$$T = D = C_D\, \rho/2\, SV^2 \dots\dots\dots\dots (4)$$

Replacing T by its value (4) in equation (2) and the speed by its value (3) in equation (1) and (2) we obtain

$$\left[\frac{C_p}{\gamma^8}\right]^{2/5} = 1/2[P^2\, N^4\, \rho^3]^{1/5} \frac{C_L}{W/S} \dots (5)$$

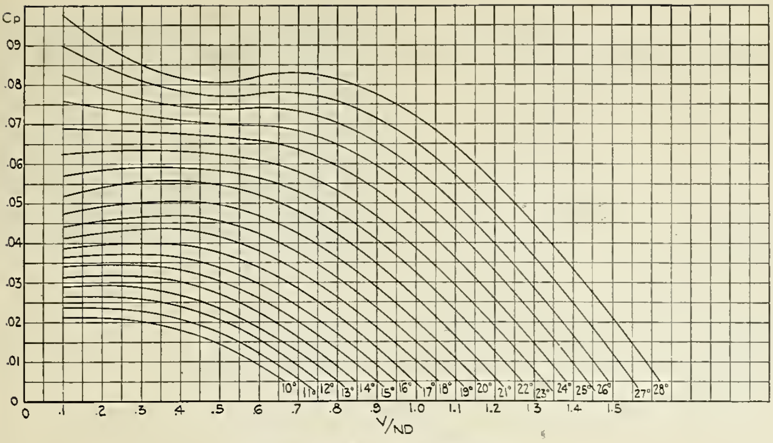


Figure 7. Power coefficient—Cp

and

$$\frac{C_T}{\gamma^4} = \frac{C_D S N^2}{4W/S}\,\rho\; C_L\, C_D \ldots\ldots\ldots\ldots (6)$$

In the above equations for the system of units generally adopted N is in r.p.s. and P in ft. lbs./sec.

Replacing in (5) and (6) r.p.s. and ft. lbs./sec., by r.p.m. and h.p. and grouping the constant we have:

$$\frac{159.10\left[\dfrac{C_p}{\gamma^5}\right]^{2/5}}{C_L} = \frac{[P^2N^4(\rho/\rho_o)^3]^{1/5}}{W/S} \ldots\ldots\ldots\ldots (7)$$

and

$$\frac{6.055\,\dfrac{C_T}{\gamma^4}}{C_D\, C_L} = (N/1000)^2\, \rho/\rho_o\, \frac{S}{W/S} \ldots\ldots\ldots\ldots (8)$$

The left hand side of the above equations can be computed for a family of propellers and a line joining the point corresponding to maximum efficiency can be drawn. This curve is represented in figure 3 and is computed from NACA Report 481, propeller data relative to the Wright J-5 completely cowled engine.

It happens that all points computed at values of V/ND ranging from .1 to 1.4 and blade angles from 10° to 28° line up on the same curve, which explains the single curve of figure 3.

Monogram (figure 1) gives a graphical solution for the right hand side of equation (7).

From the above derivation it can be seen that propellers chosen according to the procedure followed in this article satisfy the conditions of operation and constitute the solution of the problems of adaptation.

Recent Aeronautical Patents

●

The following patents of interest to readers of AERO DIGEST recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Air cooling system for motors. Jean G. Dintilhac, Paris, France, assignor to Society "Yacco S. A. F." (2,004,040)

Hollow steel propeller construction. Daniel A. Dickey, Dayton, Ohio. (2,004,102)

Variable incidence plane. Adolphe C. Peterson, Minneapolis, Minn. (2,004,214)

Aerofoil. Serge Trey and William Howard, College Point, and Alexander Chessin, Brooklyn, N. Y. (2,004,256)

Helicopter. Thorvald T. Clausen, Seattle, Wash. (2,004,310)

Aircraft. Harold F. King, Grosse Point Park, Mich. (2,004,411)

Radio steering control. Theophile E. Brockstedt, San Francisco, Calif., assignor to Washington Institute of Technology. (2,004,460)

Aerial target. Walter G. Warren, Chicago, Ill. (2,004,543)

Means of measuring the distance of aircraft from ground. Hugo Junkers, Dessau, and Heinrich Wigge, Koethen, Germany. (2,004,662)

Method of bracing the circumference of gas-inflated rigid airships. Arthur Forster, Friedrichshafen, Bodensee, Germany, assignor to Luftschiffbau G. m. b. H. (2,004,785)

Rotaplane. Edward L. Yanchus, Masontown, Pa. (2,004,885)

Navigational instrument. Henry M. Jensen, Captain, U. S. Navy. (2,004,951)

Aircraft. Haviland H. Pratt, New York, N. Y. (2,004,961)

Airplane control. Frank W. Thomas, Lincoln Place, Pa. (2,005,061)

Airplane. Harry A. Douglas, Bronson, Mich. (2,005,078)

Airplane stabilizer. Carl J. Crane, Albrook Field, C.Z. (2,007,964)

Navigational instrument. Thomas L. Sprague, U.S. Navy (2,007,986)

Apparatus for determining the true horizon independently of sight. Johann M. Boykow, Berlin-Lichterfelde, Germany. (2,008,058)

Parachute. Emil Norden, Chicago, Ill. (2,008,107)

Pitch-adjusting means for propellers. John Squires, Hagerstown, Md. (2,008,191)

Airplane positioning system. La Verne R. Philpott, Wilkinsburg, Pa., assignor to Westinghouse Electric & Mfg. Co. (2,008,401)

Control of revolving beacons. Harry H. Thompson, Pittsburgh, Pa., assignor to Westinghouse Electric & Mfg. Co. (2,008,408)

Aircraft. Edward A. Stalker, Ann Arbor, Mich. (2,008,424)

Arrangement for starting flight requiring no gliding. Hirohisa Nishi, Kimiidera-Mura, Japan. (2,008,464)

Magnetic compass. Philip F. Weber, Monmouth Beach, N. J., and Walter E. Dankau, Ozone Park, N. Y., assignors to Bendix Aviation Corp. (2,008,481)

Method of and apparatus for navigators' time keeping. Philip V. H. Weems, Annapolis, Md. (2,008,734)

Airplane. Herman Wirth, Oakland, Calif. (2,008,737)

Automatic variable-pitch propeller. Sylvanus A. Reed, New York, N. Y. (2,008,771)

Stability indicator airplanes. Gennaro Lorelli, New York, N. Y. (2,008,833)

Airplane fuselage construction. Kenneth M. Roman, Wayne, Mich., assignor to Manning & Co., Chicago, Ill. (2,008,836)

Aircraft. Beauford B. Smith, Silverton, Oreg. (2,008,843)

Propeller. Clinton H. Havill and Albert S. Walton, East Orange, N. J., assignors to Eclipse Aviation Corp. (2,008,865)

Aircraft instrument. Ralph H. Upson, Detroit, Mich. (2,008,885)

Glider. Benjamin Theodore, Hartford, Conn. (2,008,997)

Brake, and hydraulic brake. Eugene G. Carroll, South Bend, Ind., assignor to Bendix Aviation Corp. (2,009,104 and 2,009,105)

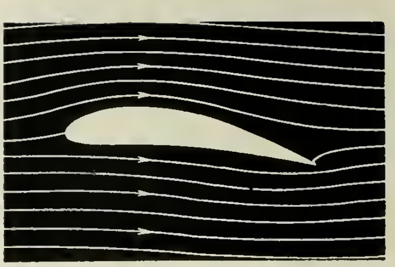
Brake. Ludger E. La Brie, South Bend, Ind., assignor to Bendix Aviation Corp. (2,009,112)

Gimbal system for gyroscopes. James B. Henderson, Blackheath, England. (2,009,263)

WING SECTION THEORY

●

DR. MAX M. MUNK

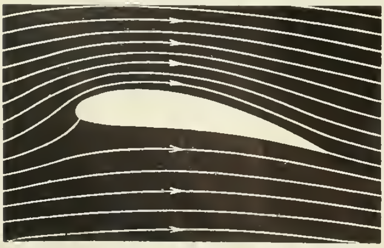


Simple potential flow

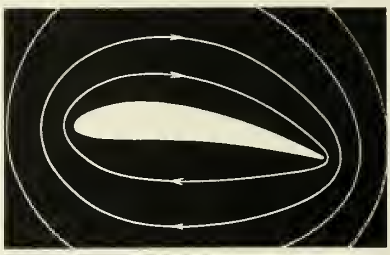
● The theory of a two-dimensional wing section moving in a perfect fluid centers around the lemna that each wing section, of whatever shape and description, possesses a fixed aerodynamic center. Referring to that center, or point, the resultant air moment has a value independent of the angle of attack, being merely proportional to the dynamic pressure, that is to say to the product of the square of the velocity of flight by half the density of air. Hence a modulus, obtained by dividing the resultant moment with reference to the aerodynamic center by the dynamic pressure, has the same value for all angles of attack, and therefore has the moment coefficient obtained from the modulus by dividing it by a suitable area, or rather volume.

The general form of the relation between the magnitude of the lift and the angle of attack is likewise the same, universally, for all wing sections. We shall demonstrate that the theoretical lift coefficient is always proportional to the sine of the angle of attack, the latter measured from the angle of zero lift.

The knowledge of these two relations offers a complete understanding of all general questions of lift variations of a wing section, of its center of pressure travel, and of its so-called stability, and furnishes practical aid to the aerodynamic research engineer, and the airplane designer. What remains of the wing section theory deals chiefly with the questions of numerically determining the constants involved in each case: the actual position of the aerodynamic center, the direction of zero lift motion, the magnitude of the constant moment coefficient with respect to it, and the lift coefficient increase per unit change of the sine of the angle of attack. These depend on the shape of the individual wing section being considered. The determination of these quantities is an involved, numerical problem since every detail of the wing section shape must be considered. Carrying out such computations calls for the services of a professional mathematician. In most cases, the engineer relies on measurements for the section constants, and only makes use of the general theorems for judicially coordinating the values. These numerical computations are then unnecessary. Even if they are performed, they have no direct bearing on the two general theorems which were mentioned previously. The instruction that the general wing section theory offers emanates from these theorems, and not from the possibilities of mathematically computing the section constants in individual cases. For that reason, the aeronautical engineer should become familiar with these theorems, and understand how they are rooted in the general principles of aerodynamics. The following discussion of the two general theorems of wing section theory is intended to familiarize him with these propositions.



Composite flow



Circulation flow

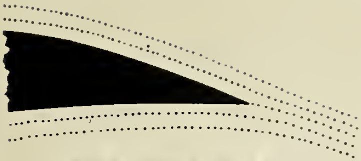
The behaviour of wing sections is governed by the fact that for the angle of attack of zero lift, the ordinary two-dimensional potential flow around the section has a downstream direction of the air flow near the trailing edge on both the upper and lower side. Consequently it represents the entire actual flow. Such simple potential flow, as indicated in *The New Bernoulli Theorem* in the August issue of AERO DIGEST has as its only possible resultant reaction on the wing section a couple, or moment, proportional to the sine of twice the angle of attack, measured from the angle of zero moment. This is a pure couple, of equal magnitude with reference to all possible points or poles, so that it cannot have any particular center.

At all other angles of attack, the simple potential flow has downflow velocity at one side of the wing tail, and upflow velocity at the other side, the air shooting around and across the sharp trailing edge in a whirl like fashion. This is contrary to nature. Accordingly, an additional constituent air motion is set up, and combines with the simple potential flow to form a resultant motion in which that anomalous cross flow is absent. This additional component flow is the circulation flow, a circuitous moving of the air in closed paths around the wing section, which fade out in magnitude at great distances from the section. The magnitude or intensity of the circulation flow as a whole is determined solely by the intensity of the tail cross flow, for it functions as its neutralizer.

That tail cross flow is a creature of the component of the simple potential flow which corresponds to a motion of the wing section normal to the direction of zero lift, since the motion of zero lift has no such tail cross flow. That motion is obviously equal in magnitude to the velocity of flight multiplied by the sine of the angle of attack counted from zero lift. It is here that the sine comes in.

The lift namely is an attribute of the circulation flow. Neither simple potential flow, nor any of its components which by themselves would be a simple potential flow, give lift. It is different however with the circulation flow. A circuitous motion of the air around the wing section involves downstream at one side and upstream at the other. The fictitious pressure effects of the New Bernoulli theorem are therefore parallel, adding up to a lift, and do not cancel out on top and bottom.

There exists only one such circulation flow for each wing section. The only possible variation is in intensity, so that all velocities at different points of the surface always change in the same ratio or proportion, as do all fictitious pressure effects of the New Bernoulli. These pressures always have the same distribution and vary only in intensity. Furthermore, since they are always and everywhere normal to the direction of motion,



Parallel trailing edge flow

they remain parallel to each other. Hence, giving to each surface element a weight equal to its area multiplied by the velocity of the circulation flow, the center of gravity of all of these weights keeps its position for all angles of attack. This is the wing section center. The lift of the circulation flow, by itself and separate from the moment of the simple potential flow, being the sum of all parallel pressure effects proportional to the weight of the surface elements must, therefore, always pass through one fixed wing section center.

In general the actual resultant lift does not pass through a fixed center of pressure, but the center of pressure travels because the lift of the circulation flow is removed from its fixed wing section center by the moment of the pure potential flow through various distances. Only under special circumstances, (namely if the direction of motion for zero lift agrees with that for zero moment) does the resultant lift pass through another fixed center, which is then at the same time a fixed aerodynamic center and a fixed center of pressure.

In the search for a fixed aerodynamic center with constant moment, we first compute the moment created by the pure lift as produced by the circulation flow with reference to a point with the Cartesian coordinates X and Y, the X direction being parallel to the direction of motion for zero lift. Since the inclination of the lift relative to the normal zero lift motion is equal to the angle of attack α, its X and Y components are equal to the lift multiplied, respectively, by the sine and cosine of the angle of attack. Since the magnitude of the lift is proportional to the sine of the angle of attack, the Y component and the X component are respectively proportional to $\sin\alpha\cos\alpha$ and to $\sin^2\alpha$. These components must be multiplied by their respective lever arms, namely the coordinates X and Y of the point with respect to which the moment is to be computed. Hence the contribution of the circulation flow to the total resultant moment can be written:

$$M' = AX\sin\alpha\cos\alpha + AY\sin^2\alpha$$

where A is constant.

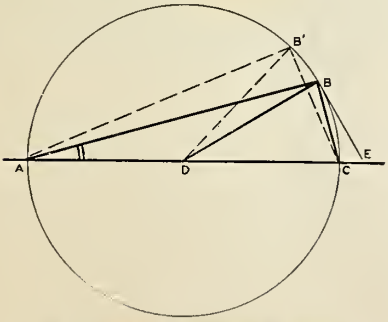


Fig. I. Diagram of constant lift change

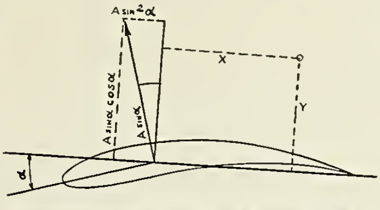
The contribution of the simple potential flow to the total resultant moment is proportional to the sine of twice the angle of attack counted from the zero moment angle, and hence to the sine of twice the sum of α and ε, where ε is a constant angle, namely the difference between the angle of attack of zero moment and of zero lift. Since $\sin^2\alpha + \cos^2\alpha = 1$ this expression, (and hence the contribution to the moment under discussion) can be written:

$$M'' = B\sin\alpha\cos\alpha + C\sin^2\alpha + D$$

where B, C and D are constants. Hence the total moment, $M = M' + M''$ can be written:

$$M = (AX + B)\sin\alpha\cos\alpha + (AY + C)\sin^2\alpha + D$$

with A, B, C, and D constants. It follows that there exists a pair of coordinates X and Y, namely $X = -B/A$; $Y = -C/A$; with reference to which the moment M is entirely independent of the angle of attack, being equal to D. The point determined by these coordinates is therefore the fixed aerodynamic center.

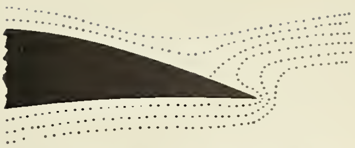


Demonstration of fixed aerodynamic center

With ordinary thin and low camber wing sections, the wing section center lies near 50% of the chord and the aerodynamic center near 25% of the chord. For most practical applications, the respective centers can be identified with these points.

As far as the theorems demonstrated deal with the position and direction of the theoretical lift relative to the wing section, their correctness cannot be impaired by the induced downwash in case of a wing with finite aspect ratio. The aerodynamic induction brings about that the effective angle of attack is smaller than the apparent or geometric angle, the one being measured relative to the moving air, the other relative to the motion of the undisturbed air. The wing flies in falling air. This cannot influence the position of the center of pressure.

Knowledge of the existence and position of a fixed aerodynamic center is of use in stability computations, because it is at the aerodynamic center that the lift variation or change, caused by a variation or change of the angle of attack, is attacking. In inquiring about the magnitude of this lift change, it is owned that since the lift is proportional to the sine of the angle of attack, it could at first be thought that its change is proportional to the cosine of that angle, because sine and cosine are mutually derivations to each other. In the present connection, this is not so, because the lift is considered in geometric relation to the wing section, in which it changes not only its magnitude, but also its direction. Hence the lift change has to be determined by giving attention to its individual components, (by considering the vectorial differences).



Trailing edge flow with cross tail flow

In Figure I, A represents the wing section center, D is the center of a circle $AB'BC$, and AC is the direction of motion for zero lift. BAC is equal to the angle of attack, and hence BDC twice that large, as central angle over the same arc BC. ABC is a right angle as peripheral angle over a diameter, AC. BC being proportional to the sine of the angle of attack BAC, it represents in suitable scale the magnitude of the lift. It also represents its direction, being normal to the direction of motion AB. Hence, when increasing the angle of attack, B moves on the circle to B' through an arc BB' proportional to the increase of the angle of attack. Hence the lift change, BB', per equal change of the angle of attack, is a vector of constant magnitude, though not of constant direction. It rather turns twice as fast as the direction of motion, AB, so that the angle CBE between the lift CB and its change BB' is equal to the angle of attack BAC.

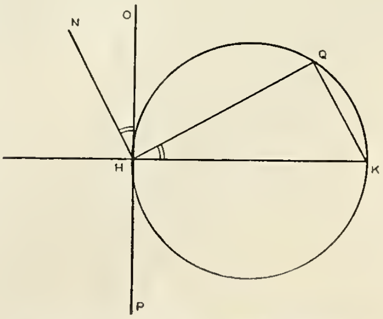
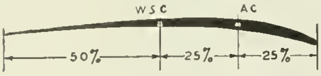


Fig. II. Diagram of fixed aerodynamic center

But in magnitude, the lift change does not vary and at all angles of attack is the same.

The knowledge of the lift change vector of constant length turning through twice the angle of attack leads to a second proof for the existence of a fixed aerodynamic center, one that is more difficult than the one already given, but more elegant because it is geometrical, not algebraic, in its nature. The lift change due to the circulation flow alone must attack at the wing section center, it being the difference of two lifts doing so.



Wing section center and aerodynamic center of a thin wing section

The moment change produced by the change of the simple potential flow must further be proportional to the cosine of twice that angle, because the moment itself is proportional to the sine of twice the angle, the cosine is the change of the sine, and with the moment no directions have to be considered. Hence this moment change will shift the constant lift change normal to the latter's direction through a distance proportional to said cosine. In demonstrating that the lift change vectors thus shifted again possess a common pole through which they pass (Figure II) H represents the wing section center, and HK is the diameter of a circle HQK, OHP is normal to KH and parallel to the lift change at the angle of attack of zero moment change. For any other direction HN, of the lift change, OHN represents twice the angle of attack measured from zero moment, and its cosine is equal to the cosine of OHN and hence to the cosine of KHQ, since the two angles KHQ and OHN are equal. Hence QH is proportional to the cosine in question, and the lift change HN is shifted to KQ, if the diameter HK is chosen with the correct length. All lift changes pass through K, and K is the fixed aerodynamic center. In other words, the radius vector HQ is made proportional to the cosine of its central angle KHQ, whence it follows that its end Q moves along a circle. At that end, a normal, QK, is drawn, which must then necessarily pass through the other end K of the diameter HK of that circle.

A Criticism of NACA Technical Report 516

● NACA Technical Report 516 reflects disparagingly without justification on some work done by the distinguished aerodynamic scientist Dr. von Karman. It repeats over and over again erroneous matter seriously reflecting on certain former work of Dr. Max. M. Munk. More important than these private wrongs, however, is the public wrong committed against the prestige of American aerodynamic science. A protest against this paper is therefore made so that the scientific public here and abroad may know that American Science outside of the NACA is far above the level witnessed by TR 516, is not blind to its blunders, and disagrees with it.

The mathematical matter in the report is needlessly inflated by copious copying from standard textbooks, such as Lamb, Hydrodynamics, Sections 103 to 106. The vicious portions of the report are thereby shielded from the attention of its examiners reading the manuscript hurriedly.

The report claims that a method described therein is more rigorous than one proposed for the same purpose in an older paper by Dr. von Karman. This allegation implies that Dr. von Karman's method is deficient in mathematical rigor. Actually, Dr. von Karman's method is unimpeachable, whereas the method proposed in TR 516 is not practical. It further fails to check in a numerical case given in TR 516 itself.

The report states that a set of linear equations infinite in number and containing an infinite number of unknowns, "provides" a rigorous solution. Common sense dictates that such set may constitute a better restating of the problem, but the author is still under obligation to provide the solution himself. This he fails to do satisfactorily.

The author's method, applied to a particular problem, gives a numerical discrepancy of about 20%, determined in the report itself by the application of an established theorem found and published by Dr. Munk in 1922, and never challenged, except in TR 516. The author excuses his discrepancy by alleging the theorem in question to be wrong, without pointing out in what respect the proof given in 1922 may be wrong.

The author did not check the allegedly wrong theorem by applying it to a special simple case, for which information is already available in textbooks. In Lamb's Hydrodynamics, fifth edition, p. 144, the expression line 12, divided by the velocity U and the volume of the ellipsoid in question, gives a factor 2/(2 — Alpha). The expression designated (12), on the same page is (Alpha)/(2 — Alpha). The difference between these expressions is equal to ONE. This must be so by the theorem of Dr. Munk now in question, but it is broadly denied by TR 516, although clearly confirmed by Lamb.

Report 516 attempts then to prove mathematically that such difference ONE generally cannot appear. The so-called proof is equivalent to the assertion that the difference of two physical properties of one and the same ellipsoid, is equal to One and is not equal to One, at the same time, according to whether the ellipsoid is represented by one set of coordinates or by another one.

TR 516 constitutes no advance of aerodynamic science, but a retrogression of same. The report elucidates no theory, but obscures it.

Mathematical papers indicate the level of logical thinking exercised at the place of their origin. What will be thought of other papers originating at our great, expensive, national aeronautic research institute, if not even its mathematical papers are basically reliable and correct?

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Torsion of Tubes

Torsion of a Rectangular Tube with Axial Constraints, D. Williams. (British) Aeronautical Research Committee—Reports and Memoranda No. 1619, May 29, 1934 (published May 18, 1935), 30 pp., 18 figs.

THE CALCULATIONS described in this report were undertaken as preliminary to the development of a general procedure for the determination of the internal actions in an airplane wing with a stressed-skin covering. The problem of a thin-walled tube is considered for constant rectangular cross section with opposite walls of equal thickness, subjected to torque and axial constraint. A solution is obtained for distributed as well as concentrated torques and for tubes with either free or encastré ends. The influence of such factors as length of tube, thickness of walls, shape and size of cross section on the magnitude and distribution of the stresses is also discussed.

Engine Flight Tests

Flight Tests of Engines and Relative Installations (Le prove in volo dei motori e delle installazioni relative), P. Ragazzi. Rivista Aeronautica, Vol. 11, No. 6, June, 1935, pp. 413-460, 17 figs.

METHODS FOR testing airplane engines in flight and the installations required are discussed. The author describes various types of tachometers, manometers, thermometers, thermocouples, speed indicators, altimeters, and flow meters and points out the features which are particularly important for testing in the air. He indicates the methods for verifying the operating conditions of the engine and of each separate part.

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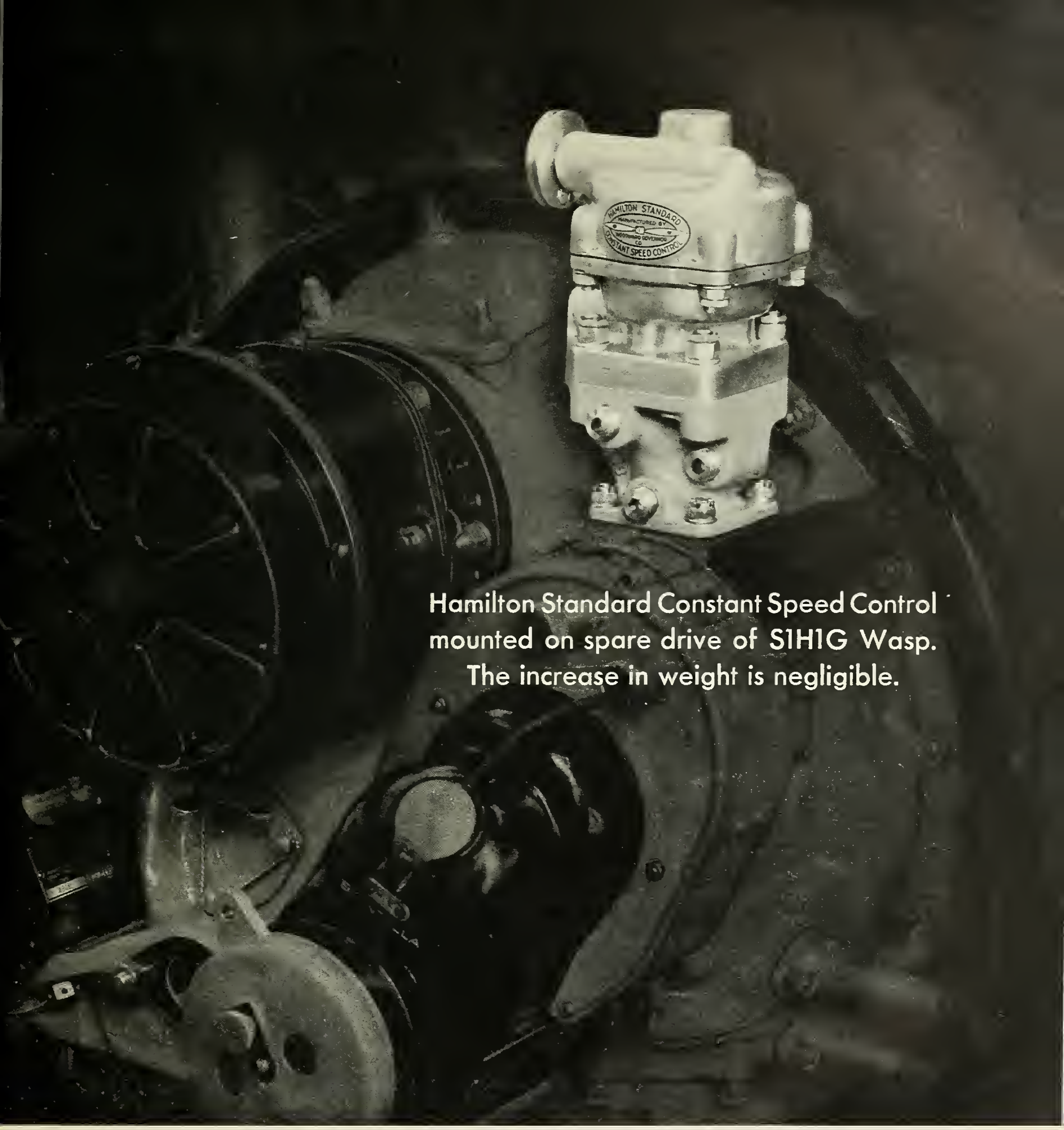

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(*Continued from preceding page*)

Hot-Wire Anemometer

Direct Calibration of Compensated Hot-Wire Recording Anemometer, C. Salter and W. G. Raymer. (British) Aeronautical Research Committee—Reports and Memoranda No. 1628, *March* 3, 1934 (*published May* 18, 1935), 9 *pp., 7 figs.*

THE EXPERIMENTS described were intended to be a check on the validity of the calculations given in the report and on the accuracy of the method used to compensate for the failure of hot-wire anemometers to record correctly current changes at the higher frequencies. The apparatus was calibrated directly by oscillating the wire in a direction parallel to that of the stream, thus inducing a variation in the velocity of the wind relative to the wire. Although the results indicated that the apparatus had been slightly over-compensated with respect to the magnitude of the variations and that compensation for phase lag was inadequate, no fundamental error was found in calculating the scales of the records.

Seaplanes

Interference Effect of the Surface of the Sea on the Characteristics of a Flying Boat, W. L. Cowley and G. A. McMillan. (British) Aeronautical Research Committee—Reports and Memoranda No. 1626, *May* 15, 1934 (*Published April* 26, 1935), 15 *pp.,* 8 *figs.*

RESULTS OF model tests are described which were carried out at the National Physical Laboratory to determine whether an interference effect occurs on the lift when a seaplane is flying near the surface of the sea. It was found that the presence of the sea increased the maximum lift by about 6%. At the lower end of the angle range the increase in lift was a greater percentage of the lift, but, although the vortex theory indicates a change of lift due to a change in the angle of incidence of an airplane, no alteration in angle was shown by the drag measurements. The increase in maximum lift also appeared to be contrary to the conclusions of the vortex theory.

Heavy-Oil Engines

The Heavy-Oil Aero-Engine E. Chatterton. Aircraft Engineering, Vol. 7, No. 73, March, 1935, *pp.* 55-64, 22 *figs.*

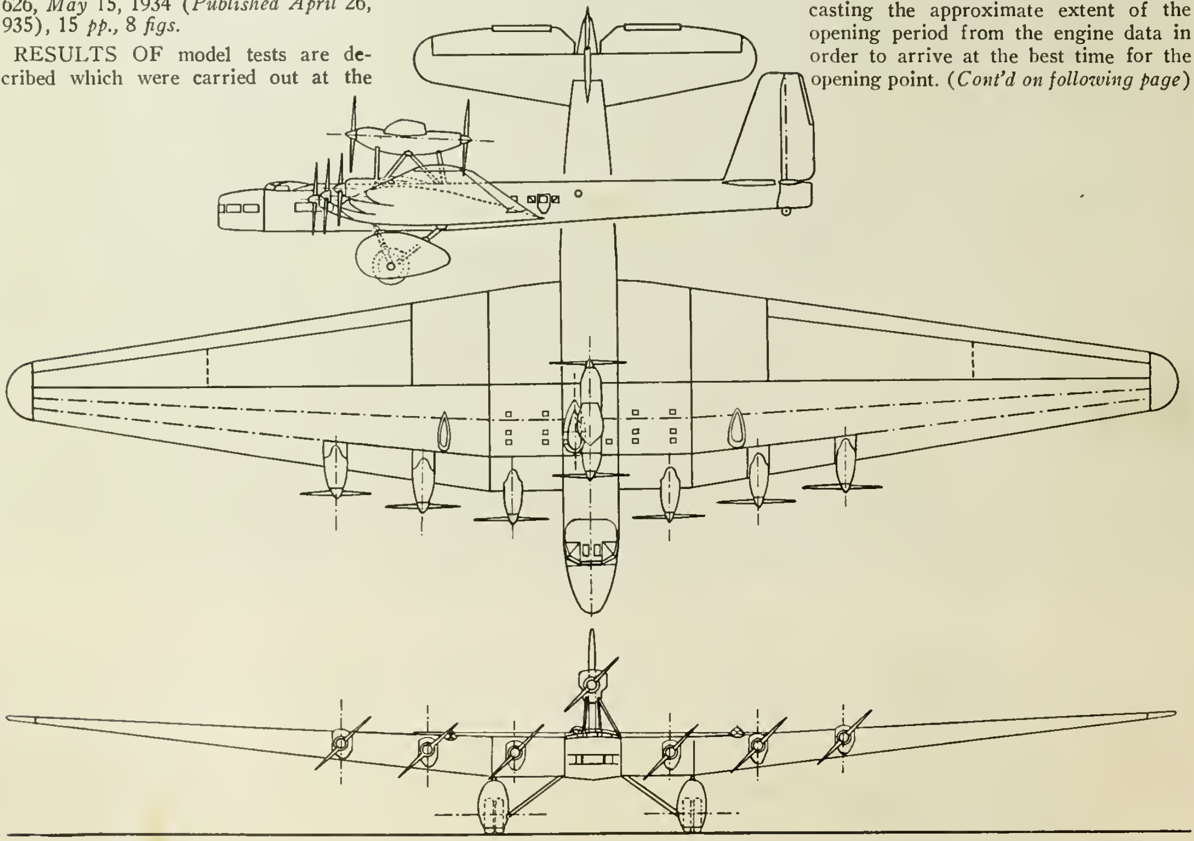
THE DEVELOPMENT of heavy-oil engines for aircraft from the early Akroyd Stuart and Diesel designs is traced. The author takes up the combustion problem and describes combustion methods in practice, referring particularly to the Ricardo *Comet* and Junkers engines. He reviews the mechanical requirements to be fulfilled by the injection system and expresses the opinion that the most satisfactory fulfilment is obtained by the use of a port-controlled fuel pump combined in a unit with an open nozzle.

He compares the designs of the Packard, Bristol Phoenix, and Junkers Jumo IV and V engines and gives a comparison of weights with those of current gasoline engines. He concludes with a discussion of supercharging and states that there is no reason why, with certain combustion and mechanical difficulties solved, the advantages of supercharging should not be coupled with the use of the two-stroke cycle.

Engine Exhaust Valves

The Functions of the Exhaust Valve, R. J. Cousins. Aircraft Engineering, Vol. 7, No. 75, May, 1935, *pp.* 107-108, 3 *figs.*

A METHOD for determining the size, lift and timing of exhaust valves in relation to engine displacement and speed is explained by the Chief of the Ricardo Design Department. The author starts from the point that, since pressures available for induction in the unsupercharged engine are very low, the inlet valve should not be penalized to allow a large exhaust valve and includes figures for determining the size of inlet necessary and the amount of space left for the exhaust valve. He defines the several phases of the exhaust period and considers each one separately. He concludes with a description of a method for forecasting the approximate extent of the opening period from the engine data in order to arrive at the best time for the opening point. (*Cont'd on following page*)



Outlines of the Russian monoplane "Maxim Gorky" described in the May issue of "Technica Vosdushnogo Flota" (Aeronautical Engineering)

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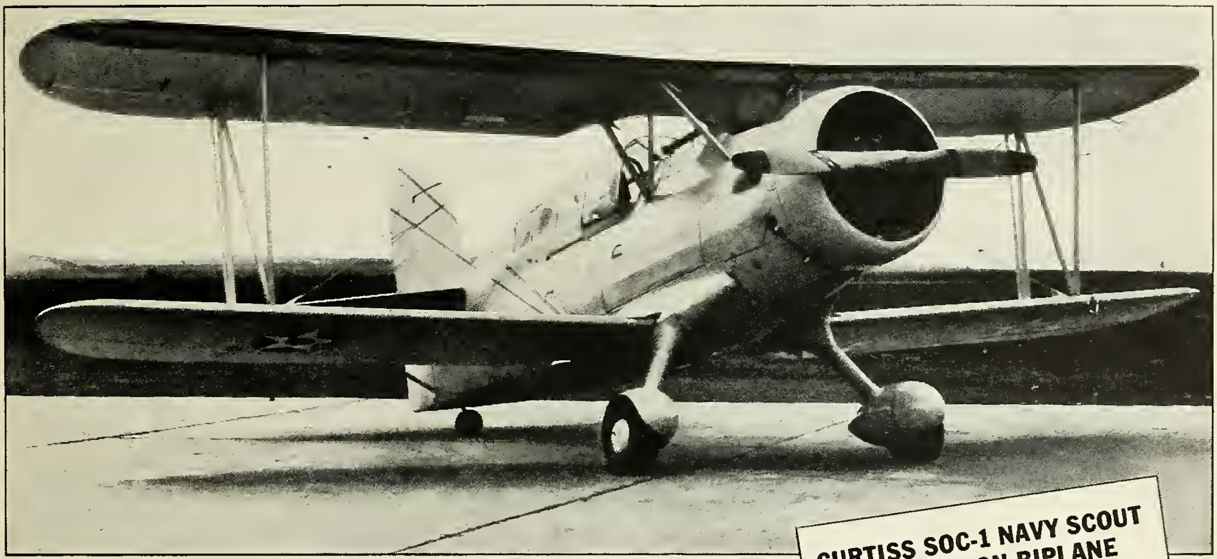

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(*Continued from preceding page*)

Seaplane Forces

Hydrodynamic Forces and Moments on a Simple Planing Surface and on a Flying Boat Hull, W. G. A. Perring and L. Johnston. (British) Aeronautical Research Committee—Reports and Memoranda No. 1646, February, 1935 (published July 25, 1935), 23 pp., 31 figs.

THE ANALYSIS of the force and moment measurements on a planing surface indicated that they may be represented by relationships similar to those of an airfoil. The lift was found to vary directly with the incidence, the slope of the lift-coefficient curve being a function of the aspect ratio of the form $CA^{0.42}$. A similar relationship was also found to hold for vee-shaped surfaces, the effect of the vee angle being to modify the coefficient C. The analysis was extended to obtain relationships which enabled the lift, drag and pitching moments of flat or vee-shaped planing surfaces to be calculated from expressions based on the projected still-water planing area.

Four-Engine Airplane Tests

Tests on Models of Armstrong Whitworth Four-engined Monoplane, W. L. Cowley, R. Warden and G. A. McMillan. (British) Aeronautical Research Committee—Reports and Memoranda No. 1624, October 23, 1933, (published July 25, 1935), 13 pp., 4 figs.

IN THE design considered four air-cooled engines were mounted on the leading edge of the wing for an airplane with a total weight of 25,000 lbs. Tests were made on 1/5-scale nascelle models to find the effects produced when four different nascelle shapes were mounted in turn upon an airfoil that completely spanned the tunnel. Tests were also made on 1/10-scale models of the plane. An analysis of the results on the complete model and on the wings alone showed that the parasite drag was about 340 lb., while the added resistance due to the undercarriage was approximately from 4 to 6 per cent of the drag of the complete model.

Aircraft Vibration

Aircraft Vibration, H. Constant. (British) Aeronautical Research Committee—Reports and Memoranda No. 1637, October, 1934 (published August 1, 1935), 30 pp., 23 figs.

A PRELIMINARY report is given of the results obtained in a systematic study of vibration in an airplane, a vibrograph being used to measure the vibration set up in the mountings of engines running on a test bed and in the fuselages of airplanes both on the ground and in the air. The chief sources of vibration were found to be the ½ order harmonic of the engine torque reaction, usually due to faulty ignition or distribution, inaccuracies in propeller manufacture, and with two-bladed propellers, the second order propeller aerodynamic couples caused by propeller axis being inclined to the relative wind, as well as the second order propeller vibration caused by periodic gyroscopic couples when turning. The author considers that most instances of serious vibration can be cured, but that such reduction in vibration may sometimes involve a loss of aircraft performance greater than justified.

Anti-Knock Fuels

Contribution to the Study of Hexanes and of some Hydrocarbons (Contribution à l'étude des hexanes et de quelques carbures d'hydrogène), A. Maman. Publications Scientifiques et Techniques du Ministère de L'Air, No. 66, 1935, 55 pp., 11 figs., 27 tables.

THE QUESTION of anti-knock fuels for airplane engines is discussed and experiments are described which were taken up in the Chemical Laboratory of the Ecole Nationale Supérieure de l'Aéronautique. The author discusses the preparation of hexane, isohexane, methyl-diethyl-methane, trimethyl-ethyl-methane and diisopropyle as well as the purification of hexanes and some hydrocarbons. He gives the measurements obtained in regard to boiling point, density, critical temperatures of solubility in different liquids, indices of refraction, infra-red absorption spectrum, and the Raman effect. In discussing the phenomena of slow combustion with increasing temperatures and combustion by ignition, he concludes that diisopropyle is very resistant to detonation.

Aluminum Alloys

A New Process for Testing the Resistance of Metallic Materials to Cracking (Ein Neues Verfahren zur Prüfung des Anfreisswiderstanden metallischer Werkstoffe), P. Brenner. Luftfahrtforschung, Vol. 12, No. 3, July 17, 1935, pp. 107-115, 23 figs.

THE CRACKING phenomenon which frequently occurs in metals in operation or during working is discussed and a new method developed for testing the resistance of metals to cracking is described. Two test pieces of Lautal which were hardened for eight hours at 140° C. broke in tension at 18.5 kg./mm², the first after 9½ months' corrosion attack. Duralumin and Lautal, hardened at room temperature under the applied test conditions, indicated no inclination to cracking, while after hardening at higher temperatures, as for example, 180° C., a decided cracking phenomenon occurred for both these materials. Plated duralumin in the heat hardened condition after 12 months' corrosion attack proved completely capable of resistance against cracking. Intercrystalline attack was indicated for Hydronalium in the grain condition tested after 12 months' corrosion testing.

Lift Distribution

A Procedure for Calculating the Distribution of Lift along the Span (Verfahren zur Bestimmung der Auftriebsverteilung längs der Spannweite), A. Lippisch. Luftfahrtforschung, Vol. 12, No. 3, July 17, 1935, pp. 89-106, 24 figs.

IN THE development of a short method for determining the lift distribution along the span of an airplane wing at various angles of attack, the author decomposes the lift distribution into four elementary distributions. By inserting the angle of attack distribution in the Fourier series for the lift distribution, he obtains a compound third series which proved to be especially advantageous. He also gives a graphical method which permits a lower approximation. Results obtained by this method are compared with those secured from other longer processes.

Report of the Deutsches Forschungsinstitut fuer Segelflug.

Canard Airplane

Further Measurements of the Properties and Performance of the Focke-Wulf F19a Canard Airplane (Weitere Messungen der Eigenschaften und Leistungen des Flugzeug Focke-Wulf F19a "Ente"), C. Biechteiler. Luftfahrtforschung, Vol. 12, No. 4, July 30, 1935, pp. 134-141, 20 figs.

THE DYNAMIC behavior of the Canard, or tail-first, airplane Focke-Wulf F19a was measured at large angles of attack and the flow condition over the forward wing, or elevator, was investigated. The effect of fairing the vertical fin root on the rudder action was determined and the influence of vertical plates, below the wing tips, on the directional stability and the top speed of the airplane was found. The plane has two engines below the wing which, with the landing gear, is at the rear of the fuselage with the rudder. The elevator, or forward wing, is on struts at the front of the fuselage with a single landing wheel below.

At large angles of attack and with a rapid setting of the elevator, it was found that the plane had longitudinal oscillations which, at a dynamic pressure of about 40 kg./m² were undamped and of constant amplitude. With a decrease of dynamic pressure, the damping was positive and increased while the period of oscillation was lower. The variation in altitude for the undamped oscillation was around 15 meters. There were no longitudinal oscillations with a slow setting of the elevators and with completely drawn elevators a stationary flying attitude was obtained at a low pressure of 30 kg./m².

Report of the Deutschen Versuchsanstalt fuer Luftfahrt.

(*Continued on page 37*)

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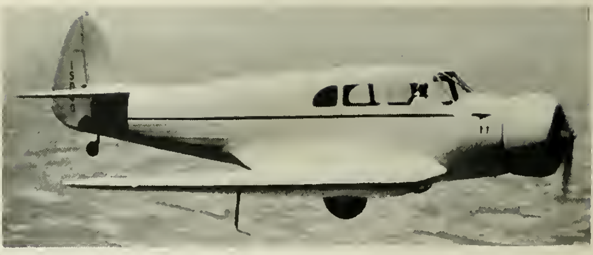
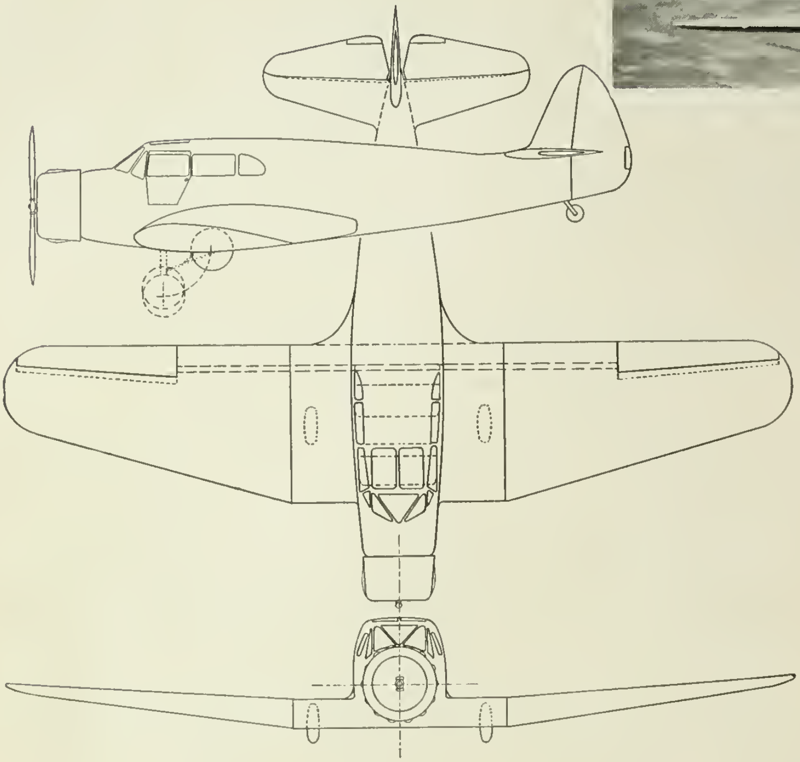
THE FAIRCHILD "45" LOW WING MONOPLANE





● The Fairchild "45," a five-place low cantilever wing cabin monoplane powered with a 225-horsepower Jacobs radial air-cooled engine, is designed for high speed commercial and private-owner operations.

The fuselage is constructed of chrome molybdenum steel tubing, fabric covered. One of its features is the large, roomy cabin, which in general design, arrangement and appointments follows modern automobile practice. Three persons can be comfortably accommodated on the rear seat and two in the front seat, with ample leg room in both sections.

The rear seat is 51" wide 18" deep, and the front seat is 47" wide and 16½" deep. A folding section in the front seat facilitates movement between the front and rear sections, and the distance from the rear wall of the cabin to the rudder pedals under the instrument board is 110". Back of the rear seat is a 12" shelf where small baggage and miscellaneous articles may be placed. A door on the right side opens directly into the rear section, and a second door is on the left side at the pilot's seat.

Hot or cold air may be admitted to the cabin from a valve-controlled duct on the side of the fuselage, the flow capacity being controlled by shutters which may be operated from either the front or rear seats. Ventilation is controlled by sliding windows in the front section of the cabin and a small vent in the roof.

The control column is the "dep" wheel throw-over type, with two locking positions provided. The two sets of rudder pedals are adjustable in flight by a foot-operated lever. Brake pedals are provided on the left side of the front section and the parking brake is at the left of the pilot. The flap lever is in the center, near the control column and the undercarriage hand crank is placed at the left of the pilot. An adjustable trimming tab control is mounted in the center of the cabin roof, conveniently located in respect to either of the front seats.

Indirectly lighted instruments are grouped in front of the left pilot position, with the throttle and mixture control to the right of the instruments, within reach of either side. The flight and engine instrument panel is mounted on rubber bushings. A master switch under the instrument panel shuts off the electric current when it is not needed.

To the right of the instrument panel (in front of the occupant of the right side of the front seat) is a large compartment for maps and small articles.

A klaxon horn and red lights warn the pilot if the wheels are retracted when a landing is about to be attempted. A green light shows when they are extended in the landing position. In addition, a mechanically-operated indicator on the instrument board shows the position of each wheel.

Supplementing the dashboard compartment and the shelf are two baggage compartments measuring 22.5" × 44" × 16" in the center section of the wing. Access is by two trap doors in the floor of the cabin which can be opened in flight.

The wing is constructed in three sections, having an NACA 2218 section at the root which tapers to an NACA 2209 section at the tips. It has an angle of incidence of 2° with dihedral of 6° beyond the center section.

Outer wing panels are of spruce box spars and spruce ribs. Drag trusses consist of aluminum alloy built-up I-sections, double wire braced with steel tie rods. Plywood covers the leading edge back to the front spar, and the balance of the panel is fabric-covered.

The center section is of aluminum alloy and extruded shapes with built-up sections used for the spar flanges. The top is covered with corrugated aluminum alloy sheet with smooth sheet over it to provide stiffness for the walkways. The leading edge and underside is covered with smooth aluminum alloy sheet. The center section houses the retractable landing gear, the baggage compartment and the two 60-gallon fuel tanks which may be removed by detaching a cover on the underside.

Split balanced type flaps extend from aileron to aileron in three sections, one on each wing panel and one on the center section panel. They are constructed of aluminum alloy tubing and metal ribs, with the leading edge covered with aluminum alloy sheet. The balance is fabric-covered. The flaps have a special NACA section with a chord of 15.5" or 19.1% of the mean aerodynamic chord, and may be locked in the closed, deflected 30° and deflected 60°, and the full down position.

The flaps are hinged back of the leading edge so that when they are deflected the leading edge swings upward and backward to fit snugly against the underside of the wing. Operation of the flaps is by push and pull rods with all hinges mounted on ball bearings. Ailerons are the slotted balanced type of aluminum alloy with fabric covering.

Tail surfaces are full cantilever, built of aluminum alloy and steel, mostly fabric-covered. Stabilizer and fin consist of two spars diagonally braced for torsional rigidity, and the leading edge back to the front spar is covered with aluminum alloy sheet. Elevator and rudders are of the Handley Page balanced type constructed with aluminum alloy ribs, mounted on steel torque tubes. Adjustable trimming tabs are operated by a thread screw at the tab. This screw is operated by a short chain over a sprocket attached to a control cable extending to the cabin.

Each wheel of the undercarriage is mounted on a single oleo spring shock leg 29.5" long and 3.5" in diameter with a 7" stroke. Each leg is braced by a folding tripod operated by a long screw attached to the rear center section spar and actuated by a crank in the cabin. The entire undercarriage is of chrome molybdenum steel with Oilite bushings. Wheels extend 11" below the wing and are free to revolve when retracted.

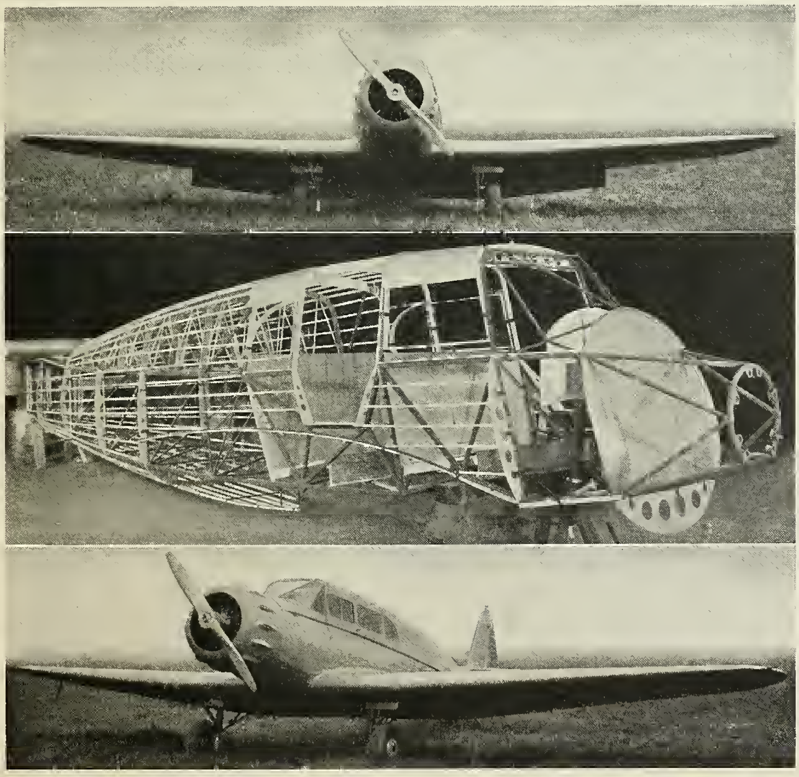
The tail wheel is of chrome molybdenum heat treated steel, swivels through 360°, and incorporates an oil spring strut.

The engine is mounted in rubber, and is enclosed in an NACA cowl and standard cowling. The side cowling is hinged about the top to facilitate inspection and maintenance, and sections of the inner cowl are removable for engine adjustment. The oil tank is located on the firewall and is accessible through a door in the side cowl.

Inspection doors are provided for access to all moving parts throughout the airplane.

Specifications and performances of the Fairchild "45" are as follows:

Wing span	39 feet 6 inches
Wing area	248 square feet
Aileron area	23 square feet
Stabilizer	19.8 square feet
Elevator	19.8 square feet
Fin	5.55 square feet
Rudder	13.95 square feet
Flaps	28 square feet
Empty weight	2277 pounds
Useful load	1323 pounds
Gross weight	3600 pounds
Payload	759 pounds
Wing loading	14.5 lbs./sq. ft.
Power loading	16 lbs./h.p.
Maximum speed	160 miles per hour
Cruising speed	147 miles per hour
Landing speed (using flaps)	48 miles per hour
Landing speed (without flaps)	60 miles per hour
Rate of climb	640 feet per minute
Cruising range	600 miles



Fairchild "45" fuselage structure and views with flaps lowered and normal

DIGEST OF FOREIGN TECHNICAL ARTICLES

(*Continued from page* 34)

Superchargers

Experimental Research in the Recovery of the Pressure in a Venturi Tube with Interposed Cylindrical Sections (Ricerche sperimentali sul ricupero di pressione in un tubo di Venturi con interposto tratto cilindrico), P. Aymerito. Laboratorio di Aeronautica della R. Scuola di Ingegneria, Report No. 70 *(Reprinted from Richerche di. Ingegneria, Vol.* 3, *No.* 1, 1935) *pp.,* 1-8, 7 *figs.*

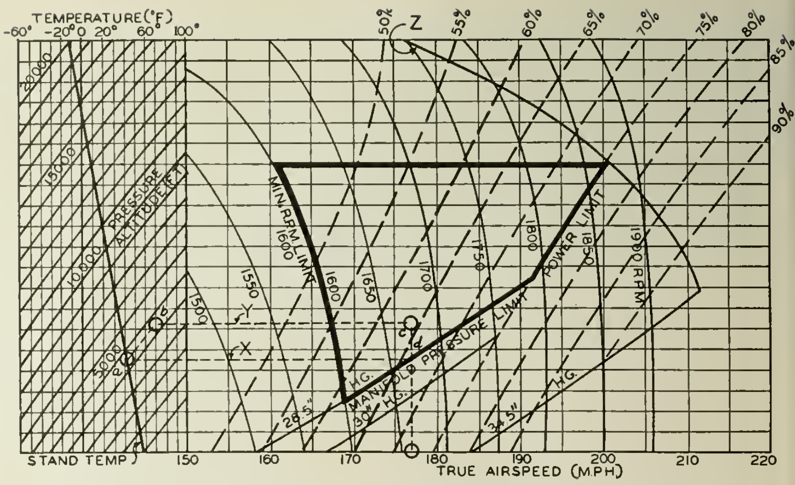
THE PROBLEM studied is of importance in the design of centrifugal superchargers for airplane engines where the highest velocity of the air at the intake of the diffuser pipe is necessary. The author describes how the recovery of the pressure occurs in a divergent tube and in a truncated cylindrical section followed by a divergence at a velocity nearly that of sound. He found that, for velocities lower than sound, large development in the diffusor was not necessary and that the diffusor sections should increase in size in the direction of the motion of the air. He conludes that the velocity of sound may even be excelled by the adoption of a diffusor having the first tube of constant section, provided that the changes in the construction of the diffusor do not prevent the realization of the phenomena which he observed in his experiments.

Seaplane Tanks

Tests on the Wall Interference and Depth Effect in the R.A.E. Seaplane Tank and Scale Effect on Hulls of Three Sizes, L. P. Coombes, W. G. A. Perring, D. W. Bottle, L. Johnston. (British) Aeronautical Research Committee, Reports and Memoranda No. 1649, *February,* 1935, *(published June,* 1935), 30 *pp.,* 37 *figs. on supplementary plates.*

THE INVESTIGATIONS described were undertaken to determine the limitations of the seaplane tank built at the Royal Aircraft Establishment, as well as to find the scale effect on hulls. Drag, attitude and rise measurements were made on $\frac{1}{18}$, $\frac{1}{12}$, and $\frac{1}{6}$ size hulls, the effect of applied moments investigated, and spray formation photographed. The magnitude of the scale effect was found to be small at low and high speeds but reached a maximum at the hump. It was also found that the tank was wide enough to test seaplane models up to 9 ft. in length without risk of side wall interference, while no depth interference would be experienced provided the model length did not exceed the depth of the water available.

GRAPHIC METHOD OF DETERMINING TRUE AIRSPEED



DC-2 cruising chart for level flight. X = pressure altitude for M.P. Y = density altitude for % power and corresponding r.p.m. Z = full throttle for standard conditions only

● The accompanying cruising chart for the Douglas DC-2 Transport is plotted to show the variation with altitude of true airspeed for various values of engine power and r.p.m. It is intended that the desired power output in level flight at any altitude can be obtained by regulating the engine r.p.m. Since the r.p.m. and percent power depend upon density altitude, a scale is given on the left for deriving the density altitude from the pressure altitude (altimeter) reading and the temperature of the atmosphere. In level flight the manifold pressure depends upon pressure altitude and requires no correction for temperature.

The DC-2 is powered by two Wright Cyclone SGR-1820-F3 engines. It has Hamilton Standard 3-bladed controllable pitch 11′ 0″ diameter propellers (Design 6111) set in high pitch at 33.75 at 42″ radius.

The following example will serve to illustrate the use of the chart: Pressure altitude, 4500 ft. (altimeter zero setting at 29.92″ hg.), air temperature 70° F. For operating at 177 m.p.h. true airspeed, the various characteristics are found as follows: From the steep diagonal line marked standard temperature in the altitude correction scale at the left, locate the pressure altitude of 4500 ft. (point *a*), move diagonally upward to the right along the pressure altitude lines to 70° F. (point *b*). This gives the density altitude of 6200 ft. Then move horizontally to the right to get the percent power and corresponding engine r.p.m., which for 177 m.p.h. are respectively 64 percent power and 1675 r.p.m. (point *c*). Manifold pressure can be checked against pressure altitudes as follows: From point *a* (pressure altitude of 4500 ft.), move horizontally to the right to a position again at 177 m.p.h. (point *d*) directly under point *c*. This point shows that 28.5″ hg. manifold pressure is required.

It should be particularly noted that engine r.p.m. and power which are determined from density altitude and the manifold pressure which is determined from pressure altitude are not obtained at the same vertical location on the chart when the air temperature is other than standard. These points will lie on the same vertical line of true velocity.

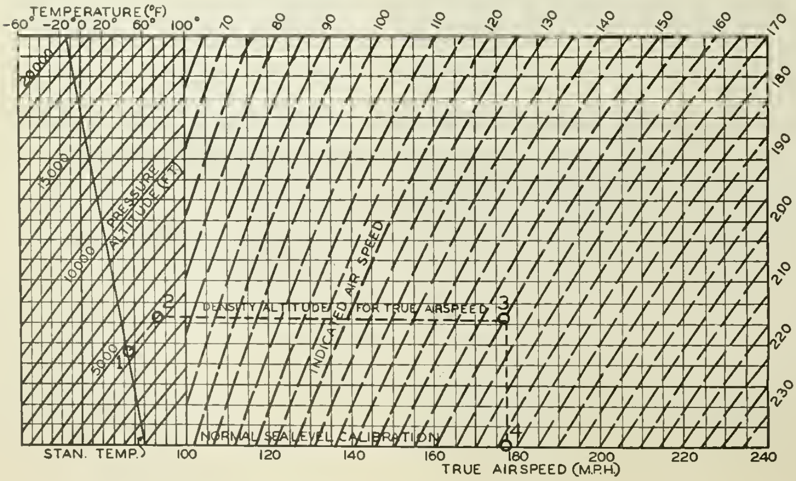
The permissible cruising region of altitudes and velocities is bounded by engine limitations on power, r.p.m. and manifold pressure and by the maximum altitude for passenger comfort. The boundary for high cruising speed at high altitude is set by the 75 percent power limitation. At low altitudes it is set by the 28.5″ manifold pressure limitation. The minimum allowable cruising velocity is determined by the 1600 r.p.m. limitation which is necessary to avoid resonant engine vibration. The highest allowable altitude for normal operation is 14,000 ft. density altitude which should not be exceeded without permission from the passengers.

These four limitations bound a region which is recommended for cruising. All normal operations should be carried out within this region.

Airspeed Correction Chart

The airspeed correction chart can be used to calculate the true airspeed of the DC-2 from the indicated airspeed meter reading. The density altitude is used since the indicated airspeed reading depends upon the density of the air. The correction chart given includes the normal sea level calibration of the airspeed meter. It will be noted on the horizontal airspeed scale at sea level that the indicated airspeed and true airspeed have different values. These differences arise from the normal sea level calibration of the instrument. The various indicated airspeed lines, moving diagonally upward to the right on the body of the chart, show the variation of true airspeed with indicated airspeed as the altitude increases so that the true airspeed determined from this chart includes all corrections necessary (that is, for pressure altitude, temperature, and normal sea level calibration of the instrument).

For an indicated airspeed reading of 155 m.p.h. at 4500 ft. and 70° F. move up the line marked std. temp. (standard temperature) to 4500 ft. (point 1) then move diagonally upward to the right along the pressure altitude to 70° F. (at point 2) which gives 6200 ft. density altitude, then move horizontally to the right to 155 m.p.h. (point 3) and obtain 177 m.p.h. actual true airspeed of the airplane (point 4).



Douglas DC-2 correction chart used to calculate true airspeed

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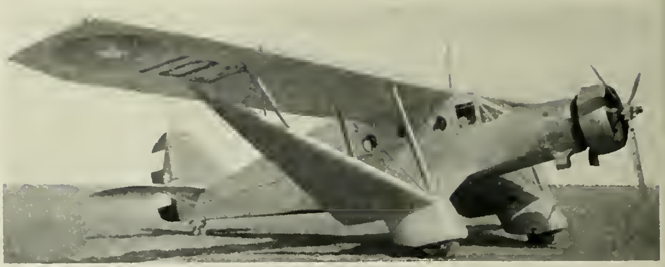
Bellanca Sesquiplane Bomber and Transport



● Bellanca Aircraft Corp., recently delivered a large single-engined sesquiplane to the Constitutional Army of the Republic of Cuba, to be used for combination bomber, cargo, transport and ambulance purposes. This plane is a further development of the 1935 Bellanca Model 66-70 Cargo Aircruiser, and its predecessors include the Army type C-27A Transport, the C-27B Transport, the Y1C-27 Transport and the Bellanca Airbus.

Known as the Bellanca Model 66-75, the ship delivered to the Cuban Army, is powered with a 750 h.p. Pratt & Whitney geared Hornet S2EG engine enclosed in an NACA cowl, and is equipped with a 12.5 ft. three-bladed Hamilton Standard controllable pitch propeller. It also was equipped with a Lear radio receiving set. The ship is also designed to take a Wright Cyclone engine.

Its fuselage is of welded chrome molybdenum steel tubing, fabric-covered and the wings are of wood with solid spruce spars and stainless steel ribs, all fabric covered, with the leading edge of thin aluminum sheet. Welded steel tubing, fabric-covered is also used in the fin and rudder, and the stabilizer is of fabric-covered wood construction. Elevators are fabric-covered welded steel. The landing gear is of chrome molybdenum steel tubing and is equipped with Aerol struts, 36 × 16 Goodyear wheels and brakes, full airwheels and streamlined wheel pants. A fully swivelling tail wheel with 16 × 7 tires is also provided.

Controls are of the throw-over wheel type. The stabilizer is adjustable in flight by a hand wheel accessible from either seat and the fin is adjustable on the ground. Ailerons are slot-balanced; dual pedals are provided, and the right hand unit is quickly removable. Control bearings are Alemite equipped, and all cables run over ball-bearing pulleys.

Instruments in the pilots' compartment are mounted on a rubber suspended panel and are indirectly lighted. They include a tachometer, oil pressure and oil temperature gauges, altimeter, magnetic compass, airspeed indicator, rate of climb indicator, turn and bank indicator, clock and fuel level gauges.

As a transport, the plane has facilities for the accommodation of 10 passengers in addition to the pilot and co-pilot. A fully equipped lavatory is provided at the rear of the cabin. Chairs are upholstered in gray leather and are installed with quickly-detachable floor lugs, so that they can be removed from the cabin. Sidewalls up to the window line are finished in mahogany plywood, and above the window line in gray fabrikoid. The floor covering is of tan linoleum.

When used for cargo purposes, a special double hinged cargo door is provided on the right-hand side of the fuselage for loading large and bulky articles, such as aircraft engines, drums of oil, fuel, packing cases, etc. This door has a maximum height of 72⅞ in. and a maximum width of 64.75 in. Available cabin cargo space measures (maximum) 15 ft. 7⅞ in. long by 6 ft. 3 in. high by 4 ft. 6 in. wide, providing a total capacity of 372 cu. ft. Beneath the floor is a steel truss member to support concentrated loads. In the form for the Cuban Army, the plane has an empty weight of 6256 lbs., a useful load of 5144 lbs., and a payload of approximately 3600 lbs., including 200 gallons of fuel (750 mile range) and pilot. Maximum fuel capacity is 300 gallons, giving a range of more than 1000 miles.

As a bomber, the plane carries underneath the fuselage a type A-3 bomb rack which mounts 30 lb. and 100 lb. demolition bombs. Release handles are located convenient to the pilot or co-pilot, and bombs may be released individually or in salvo. The rack (as provided) would carry five 30 lb. bombs, or two 100 lb. bombs.

Two fixed and unsynchronized forward firing .30 caliber machine guns can be mounted, one in each lower stub wing in a compartment with quickly removable cover. These guns are located far enough out on the lower stub wing to avoid the propeller disc. A scarff ring machine gun position is in the upper rear portion of the fuselage, having a protective hatch-type cover, which when opened can be used as a windshield for the rear gunner.

Front guns are controlled from the cockpit through an electrical trigger arrangement and the upper rear gun is independently operated by its gunner.

Brackets and straps are provided for suspending 4 litters in the cabin when the plane was conveted for ambulance use, while 2 more litters can be accommodated on the floor of the cabin, making provisions for carrying 6 injured.

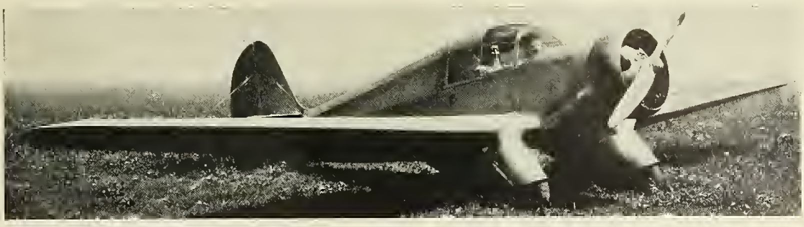
Specifications and performance of the Bellanca Model 66-75 delivered to Cuba are as follows:

Wing span	65 feet
Length overall	42 feet 9 inches
Height overall	11 feet 6 inches
Maximum speed	164 miles per hour
Cruising speed	150 miles per hour
Rate of climb	650 feet per minute
Gross weight	11,400 lbs.

Details of Bellanca gunner's hatch and stub wing machine gun placement

AERONCA C-70

Low Wing Monoplane



● Aeronautical Corporation of America has supplemented its Aeronca line by the development of a new low wing cantilever type monoplane which will be available to the market this fall.

The new Aeronca presents features which differentiate it from the high wing Aeronca C-3 which will be continued in production. Designed to take higher horsepowers than its high wing counterpart, the new Aeronca is to be offered either with LeBlond "70" or "85" engine, or the 90 horsepower Warner Junior. Each will have a Townend ring.

The cockpit provides side-by-side seating, with a coupé top arrangement which affords maximum visibility in essential directions. The landing gear is of the individual fixed cantilever type, with wheels enclosed in full streamlined pants which fair into the wing leading edge. Tail surfaces are wire braced by a single streamline wire running from the trailing edge of the fin to the stabilizer.

The model powered by the LeBlond "70" is known as the C-70; that utilizing the "85", as the C-85. Each is identical in constructional details, only the performance varying according to the engine used. The C-70 has a maximum speed of 115 m.p.h. at 800 ft., a cruising speed of 100 m.p.h. and a landing speed of 50 m.p.h. Comparable figures for the C-85 show 120, 105, and 50 m.p.h. respectively. Rate of climb of the lower horsepowered model is 450 ft. per min. for the first minute, and for the C-85 it is 600 ft. per min. Service ceilings are 13,000 and 16,000 ft. respectively. Both have a fuel capacity of 25 gallons, sufficient for 5 hours of cruising operation, and each is provided with a two-gallon oil tank.

While both models have the same gross weight, 1500 lbs., other weights are as follows (C-85 weights appear in brackets): empty weight, 875 (865) lbs.; useful load, 625 (635) lbs.; payload, 290 (300) lbs. Wing loading is 10 lbs./sq.ft. for each and power loading is 21.4 lbs./h.p., for the C-70, and 17.65 lbs./h.p. for the C-85.

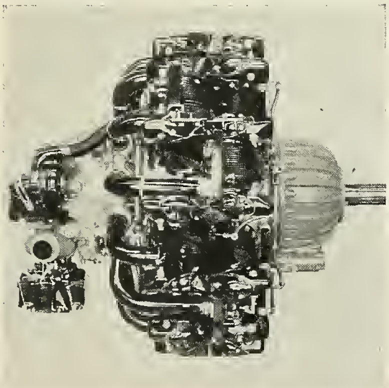
Dimensions of both models are: overall length, 22.6 in.; overall height, 7 ft.; wing span, 36 ft.; and wing area, 150 sq. ft

HOWARD HUGHES' 1000 HORSEPOWER RACING MONOPLANE

● Completed after eighteen months of engineering and construction, the Howard Hughes Racer underwent its initial tests at the Grand Central Air Terminal, Glendale, where it was built by the Hughes organization in Charles Babb's hangar. The design and engineering supervision of the plane is the effort of Dick Palmer, and G. E. Odekirk had charge of the shopwork.

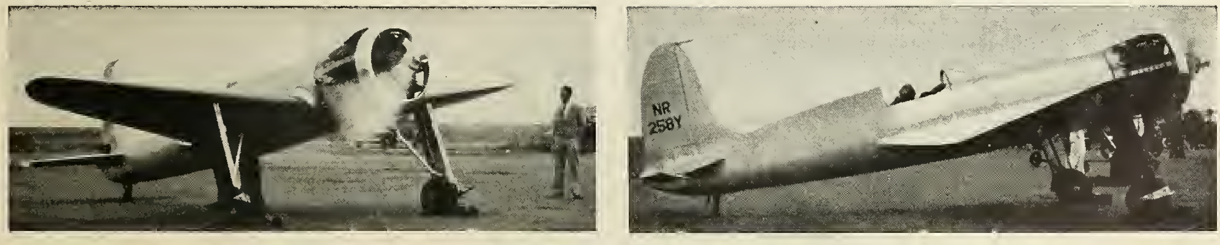
The fuselage is constructed of dural, has a length of 27 ft., and is of the true monocoque type, with all external surfaces flush-riveted. The single seat is adjustable and is placed behind an adjustable windshield and rubber mounted instrument panel equipped with a complete set of instruments. The wing has a span of 25 ft., and also is of the monocoque type, built up of a combination of wood and metal, and carrying in wells on its underside, the retracted wheels and landing gear struts which fair completely into the space provided. The total wing area is 140 sq. ft. Tail surfaces are of metal construction, of the full cantilever type. The rudder and elevators are fabric-covered. Mechanically-operated flaps are provided.

The landing gear has a tread of 10 ft., is hydraulically retractable and of the individual type, and is equipped with low pressure tires and oleo shock units. Landing gear struts are of the box-type built of riveted sheet dural. The tail skid is steerable and retractable and is also equipped with oleo shock absorbers. There are four fuel tanks having a total capacity of 250 gallons, and equipped with quick-dump valves.



Power is supplied by a 3:2 geared Pratt & Whitney Twin Wasp Jr. rated 700 h.p. at 8500 ft., but capable of delivering 1000 h.p. for racing purposes. It is equipped with a constant speed controllable-pitch Hamilton Standard metal propeller, and has a bare weight of 994 lbs., including the Stromberg carburetor, Scintilla magnetos, oil pump, spark plugs, tachometer, and generator drives. The standard Twin Wasp Jr. engine of the SA1-G Series has a bore and stroke of 5.187 in., and a 1535 cubic inch displacement. Its overall diameter is 43.875 inches, and its overall length 54.5 inches.

While official data concerning the plane is unavailable at present, complete wind tunnel tests conducted at the California Institute of Technology showed it to be capable of a speed of 365 m.p.h.



Howard Hughes' racing plane powered with a Pratt & Whitney two-row radial engine developing 1000 h.p.

CURRENT PRACTICE IN INSTRUMENT PANEL LAYOUT

●

(Continued from the August issue)

● Much research has been conducted, both here and abroad, to determine generally the characteristics of instrument vibration. Engineers of the Sperry Gyroscope Co. have developed a system of insulating panels, pointing out, among other things, the following:

First, the panel should be sufficiently rigid and stiff to prevent flexual vibration, with a heavier gauge being used as the panel becomes larger and the distance between supporting points greater. Second, the instruments should be arranged as symmetrically as possible in respect to weight distribution to avoid making the panel top- or bottom-heavy or one-sided. Third, connections to the instruments should terminate in flexible rubber and flexible metal hose couplings. And fourth, if shock absorbers are used to make the panel vibration-proof, they should be mounted in a plane parallel to the instrument board and passing through the center of gravity of it.

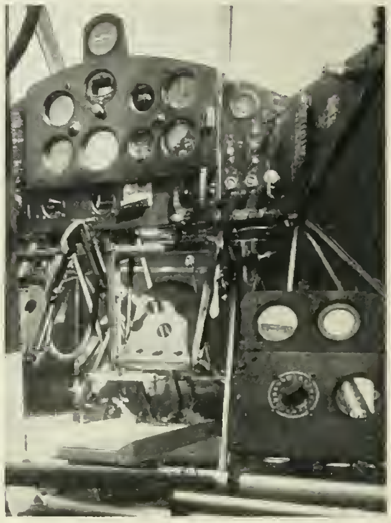
It has been found that the most effective means for developing elastic properties of a resilient material used as vibration insulation is to load it in such a manner that the principal strain in the material shall be shear. Shear type mountings give an initial tension condition to the rubber and a characteristic of being many times as stiff radially as axially.

Shear type rubber mountings are being produced by the Lord Manufacturing Co. whose plate form mountings are used almost universally for the Sperry gyroscopic installations.

The following installations will be described, as in the August issue, reading from left to right and from top to bottom.

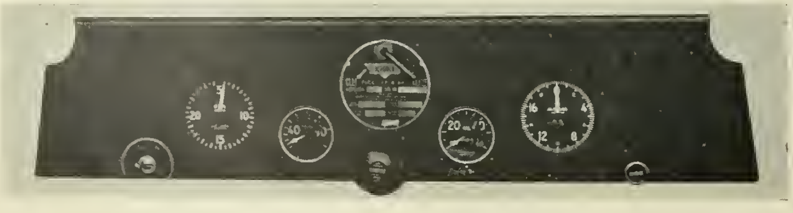
Aeronca C-3

Pioneer instruments are used exclusively on the 1935 Aeronca C-3 instrument panel. Mounted so that the pilot views the instruments at approximately a right angle, the board is made of dural and crackle finished in the color predominating on the plane. It is attached to the fuselage tubing to reduce vibration.

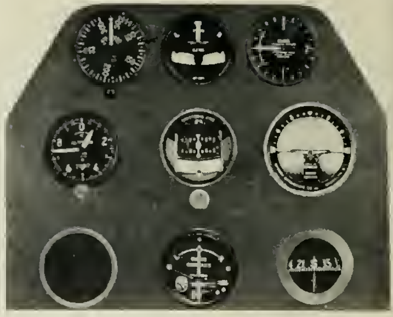


Fairchild's Cargo plane installation

The tachometer is on the left side directly in front of the pilot. Next is an oil temperature gauge. On the right side of the panel is the oil pressure gauge and next to it the altimeter. The ignition switch is on the left lower side and the fuel shut-off handle directly over the throttle, in the center. The throttle lever is of the Arens control type using a special flexible shaft, and is mounted directly in the center of the panel. There is no spark control as this is taken care of by a special control connecting with the throttle in the carburetor. The choke is on the right lower side, and there is additional space remaining for an air speed indicator and navigation light switch, which duplicates the ignition switch. These parts are extra equipment and do not come standard with the plane.



Simple arrangement of the instruments on the Aeronca C-3



An arrangement conforming to the Stark 1-2-3 instrument flying system

The Pioneer compass is below the instrument board and in the center of four tubes, approximately 1 foot above the rudder pedals.

Fairchild Cargo Plane

The instrument panel of the Fairchild XC-31 Cargo plane is placed directly before the pilot, and is flanked on either side by an electrical unit panel. A third instrument panel is at the extreme right, below the level of the eye, and on an even keel with the rudder pedals.

Center panel: rate of climb indicator; airspeed indicator, radio compass, compass, tachometer; densitive altimeter, Sperry gyro-horizon, Pioneer-Elgin clock, engine gauge unit. Below this panel are the flap position indicator, wheel position indicator, Lux fire extinguisher handle and the electrical and manual installation for operating the landing gear.

Left panel: (not completely shown in illustration) electrical toggle switches for navigation, landing and the other lights.

Right panel: fuel quantity indicator; fuel toggle switches, fuel gauge switches; carburetor heater control, cabin heater control, primer; Weston oil temperature indicator.

Lower panel: manifold pressure gauge, airspeed indicator; thermocouple selector control, Lewis thermocouple.

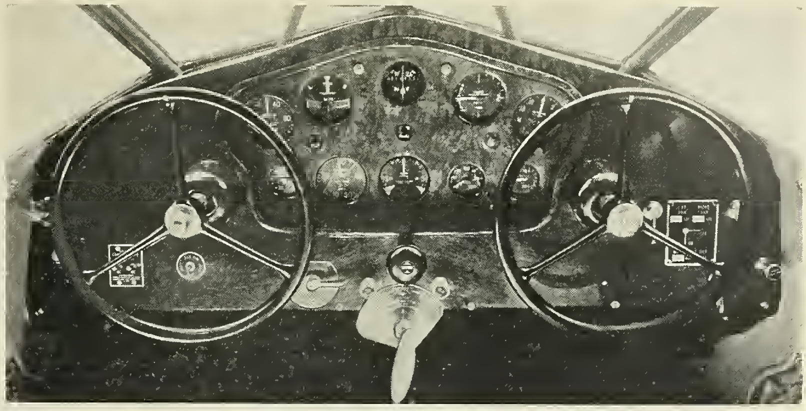
Fairchild 24

Instrument boards of the Fairchild 24 are so arranged that by removing plates covering round openings on the panel, additional instruments may be installed without difficulty and without marring the unit. The designers have taken into consideration the fact that purchasers may like to have instruments arranged in proper "blind" flying rotation, and have provided for this in the layout.

Standard equipment consists of oil temperature and oil pressure gauges, altimeter, tachometer, airspeed indicator, and compass, and unless requested by the purchaser, Aeromarine products are used.

The flight instruments are grouped at the left in a separate and removable panel. At the right is a map compartment in outward shape similar to the instrument panel. Between these panels are the oil pressure and pressure gauges, fuel tank switch, Scintilla magneto switch, throttle, spark and mixture controls. At the extreme right (not shown in the accompanying illustration) are the instrument and navigation light toggle switches. The primer is at the extreme right.

Left panel: airspeed indicator; tachometer, compass, altimeter.



Stinson Reliant panel with built-in wheel controls

Stinson Reliant

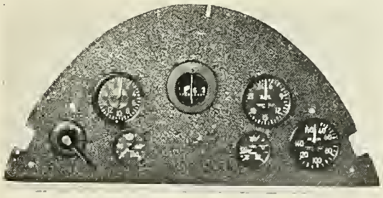
The new 1935 Stinson Reliant instrument panel assembly includes the aircraft control wheel columns, thus increasing leg room in the cabin. The new installation enhances the general outline of the layout and presents a compact and business-like arrangement. Stinson engineers have arranged the control wheels so that they fit into the instrument panel at each end. Pulling the wheel out corresponds to pulling back on the stick and pushing it in accomplishes the same results as pushing forward on the stick. To insure accuracy and longer life, the Kollsman instruments are mounted in rubber shock absorbers.

A panel fits into the instrument board and is so situated that it can be read easily by either or both of the pilots. Set below the panel, within reach of the pilots is the throttle spark control, mixture control and the controllable-pitch propeller handle. The flap control switch is forward of the left wheel control, as is the triple instrument and navigation light toggle switch, landing light switches, Scintilla ignition switch and primer. In front of the right wheel control are switches for right and left fuel tanks, and the cabin heater control.

Center panel: airspeed indicator, Pioneer turn and bank indicator, compass, rate of climb indicator, altimeter; carburetor temperature gauge, manifold pressure gauge, tachometer, oil pressure gauge, oil temperature gauge. Unless otherwise specified, instruments are Kollsman.

Ryan S-T

The accompanying illustration shows the standard equipment which is included in the 95 h.p. and 125 h.p. models of the Ryan S-T. The instruments, all of which are luminous dial, are so arranged that a turn and bank indicator or some optional equipment can be installed. The board has a black crackle finish and instruments are so arranged that they are within easy vision of the pilot.



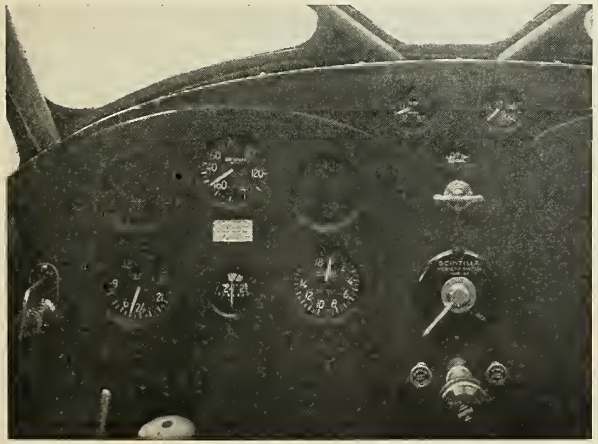
Ryan S-T instrument panel

The arrangement of instruments calls for the magneto switch at the extreme left, an altimeter, compass and tachometer; and an oil temperature gauge, thermometer and airspeed indicator. Instruments are of Aeromarine manufacture.

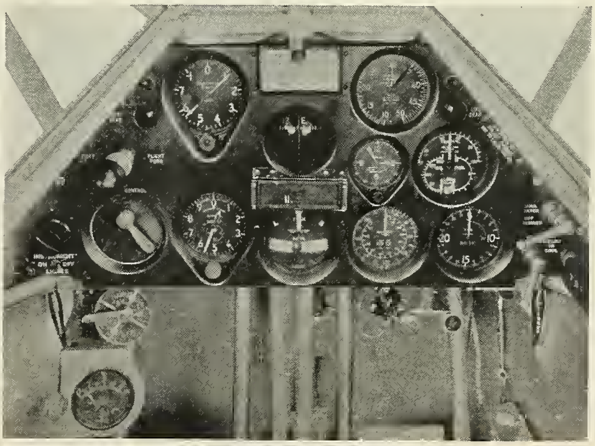
Curtiss Hawk

On the Curtiss Type III Hawk, a landing gear warning light is next to the accelerometer, and another landing gear light is at the right of the manifold pressure gauge. The compass occupies the center of the panel, having a clock and engine gauge unit consisting of the oil and fuel pressure, and oil temperature indicators at its right. The bottom row includes the instrument light rheostat and switch, Navy-type ignition switch, sensitive altimeter, turn and bank indicator, airspeed indicator, and tachometer.

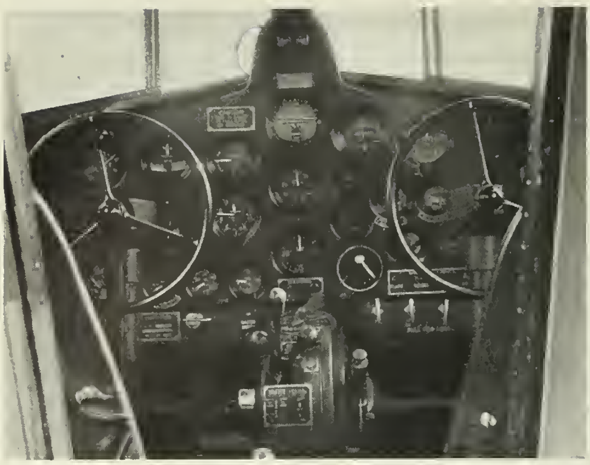
To the right of the panel and mounted on a plane with it, are the carburetor and oil heater control handles. Beneath the panel are the starter control, priming pump, fuel tank control valve, and the engine temperature indicator.



Left half of Fairchild 24 instrument panel



Curtiss Type III Hawk military installation



Vultee V1-A panel arrangement

Layout of Douglas DC-2 instruments

Vultee V1-A

Aircraft Development Corp., uses a three-sectional indirectly-lighted arrangement for the grouping of the instruments and the auxiliary and necessary equipment. The principal instruments are mounted on the central panel. To either side of it are panels which contain the electrical circuit indicators, fuses, and instrument controls.

Center panel: compass, Sperry gyro-horizon, Weston air temperature indicator, Kollsman sensitive altimeter; Pioneer airspeed indicator, Pioneer turn and bank indicator, Pioneer rate of climb indicator, Kollsman manifold pressure gauge, Motometer left tank fuel indicator, Motormeter right tank fuel indicator; clock, Sperry directional gyro, Kollsman altimeter, switch for outside; Weston cylinder head temperature indicator, Pioneer oil temperature indicator, Pioneer oil pressure gauge, Pioneer fuel pressure gauge, Pioneer tachometer, ignition switch, flap position indicator, landing gear position indicator; pitot heater and fuel pressure waring lights.

Left panel: Weston ammeter, Weston voltmeter; rheostats for compass, instruments and airspeed indicator lights, starter booster push button, starter pull handle, voltmeter circuit switch.

Right panel: Pioneer suction indicator, Eclipse air regulator valve, instrument vacuum check valve, switching valve.

Left and right panels are not shown in the accompanying photograph, but are shown in the detailed description of the Vultee installation in a separate article by William Lawrence Lewis in this issue.

Douglas DC-2 Transport

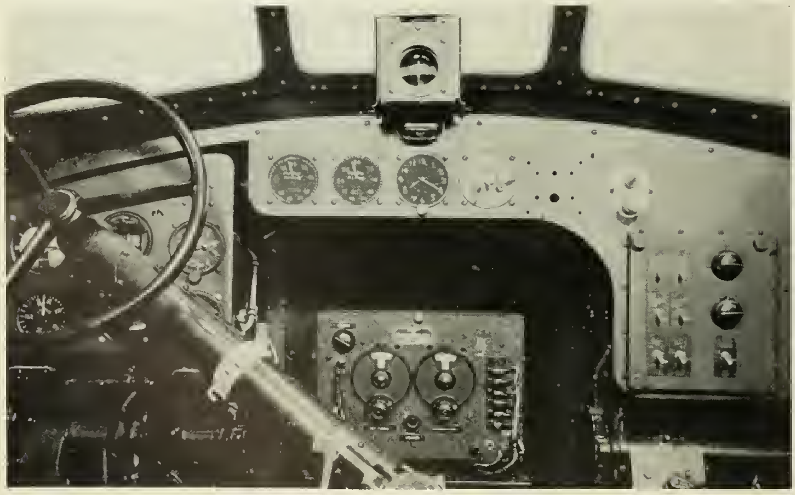
Instrument boards on the widely-used Douglas Transport are supported by six brackets uniformly spaced for shock mounting and weight distribution. The supports consist of two parts—one attached to the instrument board assembly, and the other to the ships structure. Both are connected together by a rubber shock mounting drive. The gyropilot is mounted independently of the instrument board on specially-designed shock mounts, and the electrical instruments and equipment are located in the lower right hand part of the board, enclosed in a completely electrically-shielded and hinged junction box which is an integral part of the instrument board assembly. The compass is directly above the instrument board on the centerline of the windshield.

Center panel: Sperry gyropilot installation.

Left panel: This panel is "L"-shaped with the horizontal section extending underneath the gyropilot installation and containing from left to right the Pioneer airspeed indicator, Pioneer turn and bank indicator, Kollsman sensitive altimeter, Pioneer rate of climb indicator. The vertical portion contains a clock, two Kollsman manifold pressure gauges, two tachometers.

Right panel: engine fuel pressure warning indicator lights; fuel pressure gauges, oil pressure gauges; engine temperature indicators, Weston oil temperature gauges; fuel quantity gauges; ice warning indicator.

An enlargement of the accompanying illustration of the DC-2 instrument panel was featured on the frontispiece of the April, 1935 issue of AERO DIGEST.



Douglas Dolphin arrangement as seen from the pilot's seat

Douglas Dolphin • Amphibion

Unlike the Douglas transport, the Dolphin's instrument boards are in two panels, the left unit being shock mounted and containing the navigation and flight instruments.

The right hand panel contains engine instruments and electrical equipment, is rigidly mounted to the ship structure, and is hinged for easy inspection, maintenance and repair. The illustration shows a Pan American Airways radio installation, the unit being disposed under the left portion of the right panel.

Left panel: Sperry gyro-horizon, Sperry directional gyro, sensitive altimeter, Pioneer airspeed indicator, Pioneer turn and bank indicator, rate of climb indicator.

Right panel: manifold pressure gauges, clock, ignition switch, primer; electrical switch bank, cabin and instrument light rheostats, heat switch.

Northrop Delta

Instrument panel installation on the Delta models follows the dictates of the owner of the plane. Only one type, however, is illustrated and described, although all are basically similar in construction.

The instrument panels flank the throttle controls on both sides.

Left panel: Pioneer ball bank indicator; Pioneer compass, Sperry directional gyro; Pioneer rate of climb indicator, Pioneer turn and bank indicator, manifold pressure gauge; Kollsman sensitive altimeter, Pioneer airspeed indicator, Pioneer tachometer, clock.

Right panel: Weston ice warning indidicator; Weston oil temperature indicator, Pioneer oil pressure, and fuel pressure gauges; Weston carburetor air temperature indicator, Pioneer oil temperature indicator, Pioneer fuel gauge.

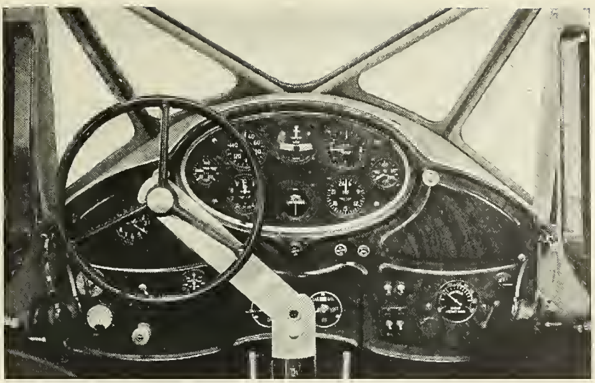
Switches for all lights and heaters are arranged in a row across the bottom of the entire panel, and beneath, in the centerline of the plane is a voltmeter.

Below the throttles is a flap indicator; below that is the spark control and the switch for the bank and turn indicator, engine pump, venturi and engine blower valves. The flap control and master switch are directly beneath the valve switch. To the extreme right is a fuel pressure indicator with warning line.

Northrop Gamma

Placed behind the mail and express compartment, the pilot in the Northrop Gamma mail plane faces a compact and well-laid-out instrument panel containing the essential flight and engine instruments.

In the lower left corner is a Weston oil temperature gauge, while above it to the left is the switch for the bank and turn indicator, engine pump, venturi and engine blower valves. Top panel: clock, Pioneer turn and bank indicator, Sperry gyro-horizon, compass; manifold pressure gauge, Pioneer tachometer and airspeed, directional gyro, Pioneer rate of climb, Kollsman sensitive altimeter, standard altimeter. Lower right panel: Pioneer oil pressure gauge, air temperature indicator; oil temperature indicator, carburetor air temperature indicator; Pioneer fuel pressure gauge, fuel gauge.



1935 Waco Custom cabin plane features a three-panel instrument arrangement

Waco Cabin Planes

Waco has found its instrument panel style and arrangement so suitable that the same general layout has been adopted for its 1935 cabin series. In fact, on the Standard Series cabin, which is in a way a continuation of the 1934 model, the instrument board is the same. On the Custom series cabin, (Waco's new 1935 model) the general outline is the same except that the panel is indirectly lighted.

Arranged in four sections, the instrument panel contains an oval inset portion on which are the flight and engine instruments. This section fits into the panel and on top blends into the cowl line of the cockpit.

Upper center panel: Pioneer airspeed, and turn and bank indicators, rate of climb indicator; Kollsman altimeter, compass, tachometer. An oil temperature gauge flanks these instruments on the left, and on the right is an oil pressure gauge. Directly beneath is the throttle, and to the right the mixture and spark controls. The clock is in the upper left panel.

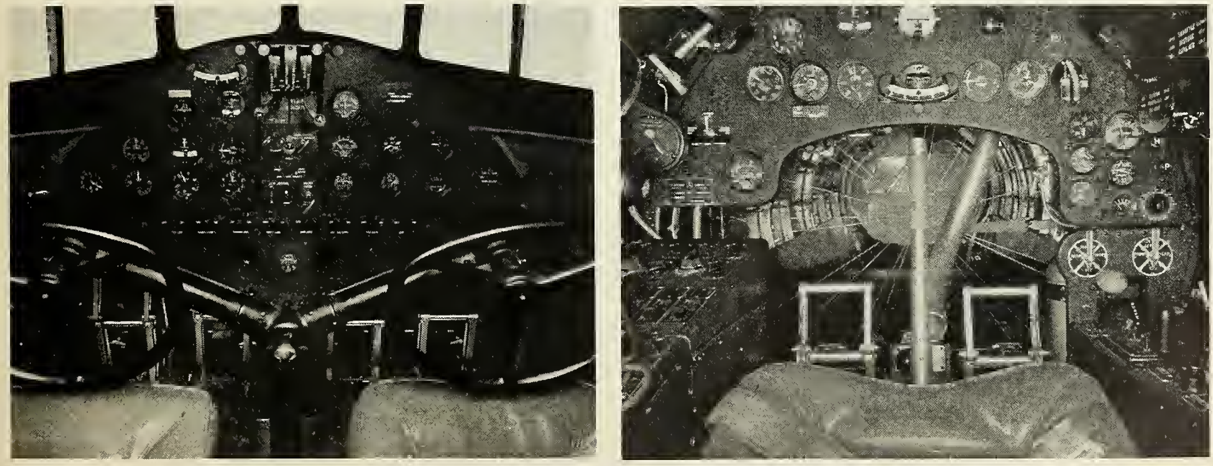
Lower left panel: Eclipse starter, ignition switch, air pressure gauge for starter. The Weston ammeter and the primer are on the same panel.

Lower right panel: toggle switches for the landing lights, radio installation.

Fuel tank switches are directly ahead of the central control column and below the throttle.

All standard instruments are Pioneer or Kollsman on the Custom Series and Aeromarine on the Standard Series.

(To be continued in October)



Northrop's Delta and at the right the Gamma's instruments aft of the mail and express compartment

Vultee Transport Instrument Installation

●

WILLIAM LAWRENCE LEWIS

Designer, Airplane Development Corporation

● Problems involved in the design of instrument panels and their equipment are always difficult of solution to the satisfaction of all concerned, for each pilot has his own idea regarding the placement of instruments and their relative importance.

Modern aircraft, as represented by the Vultee transports, have additional complications over conventional types with the inclusion of retractable landing gear, mechanically operated flaps, two-way radio, air conditioning provisions, etc. Such features have various indicating devices which are part of instrument equipment and must be taken into consideration in the design of instrument installations.

A few definite rules are familiar to those who have had anything to do with instrument panel design, such as placing important navigation and control instruments in the line of normal vision from the pilot's seat, grouping of power plant gauges, accessibility and proper lighting of the entire panel. However, there are no other general rules which apply to all installations as each presents a special problem to be solved according to the requirements of each type of airplane.

In the Vultee, the principal instruments are mounted on a central panel, to either side of which are panels which contain auxiliary apparatus in the form of electrical circuit indicators, fuses, and instrument controls.

Figure 2 illustrates a combined fuse and indicator panel which is mounted to the left side of the main board. In effect this panel is a box with a hinged lid which forms the panel when closed. Inside are mounted all circuit fuses excepting one in the starter battery circuit. This arrangement makes the replacement of fuses a simple matter as spare fuses are also contained within the terminal box. Also, accessibility to the interior is obtained by hinging the panel on its lower edge and securing it by two Dzus fasteners attached to the upper edge.

Wiring the panel and fuse box before it is installed facilitates assembly and gives a neat workmanlike job. Breeze connectors and shielding are used.

There are individual rheostats for the compass, instruments, and airspeed indicator. These rheostats contribute to the usefulness and efficiency of important instruments, by providing a lighting intensity which may be controlled at the will of the operator. Illumination of the compass and airspeed meter may be varied by their individual light circuit rheostats, and the several lights distributed throughout the main panel are controlled by a rheostat provided for that purpose. This arrangement makes possible selective lighting for night flying or blind instrument navigation in which instances the pilot needs proper instrument illumination.

On the panel are two Weston electrical indicators, an 0-20 voltmeter and a 30-0-30 ammeter. The voltmeter is normally connected to the battery circuit but may be momentarily switched to the generator circuit by operating a single pole, double throw Cutler-Hammer switch. Release of the switch handle automatically cuts the voltmeter back to the battery circuit. Battery current is measured by the ammeter which is permanently connected in the circuit.

Accidental starting of the engine is obviated by the wiring of the booster push button which is also mounted on the panel. The circuit is arranged to be open as long as the ignition switch is cut or on the *off* position. This is contrary to conventional installations in which it is possible to start the engine on booster without closing the ignition switch, and when once started, the engine will continue to run on booster so long as the starter switch is operated.

Provisions have also been made to wire the starter pull switch circuit so the starter will not operate with the ignition switch off. The danger of unintentionally starting the engine under these conditions is not so great as with the booster switch mentioned above. However, it is possible to turn over the engine by energizing the starter motor with an *off* ignition switch. In this instance, the engine will not function unless the magnetoes are cut in by the switch.

Figure 3 shows front and rear views of the auxiliary panel which is mounted to the right of the main instrument board. On it are a Pioneer suction indicator, an Eclipse air regulator valve, an instru-

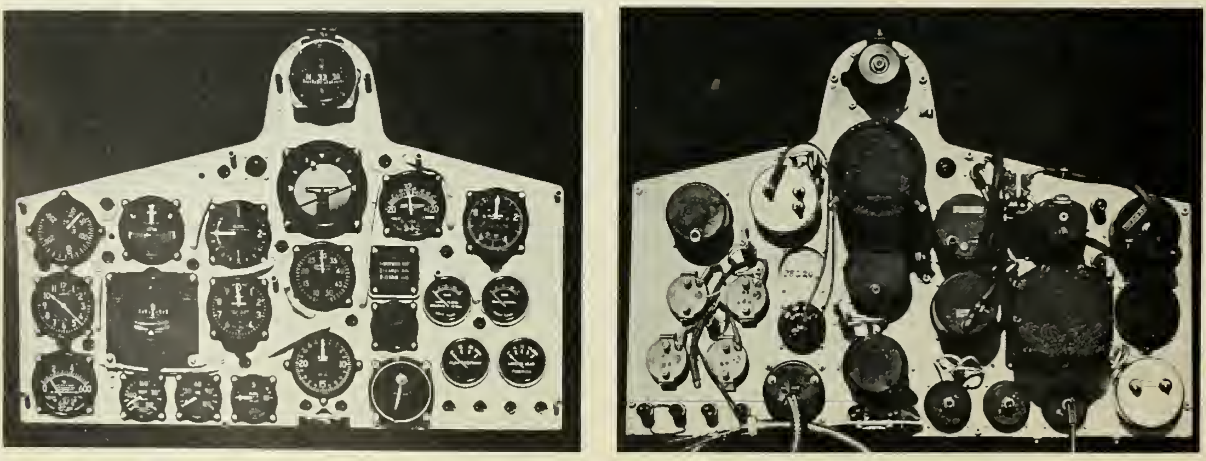


Figure 1. Front and rear views of Vultee panel with indirect lighting frame removed

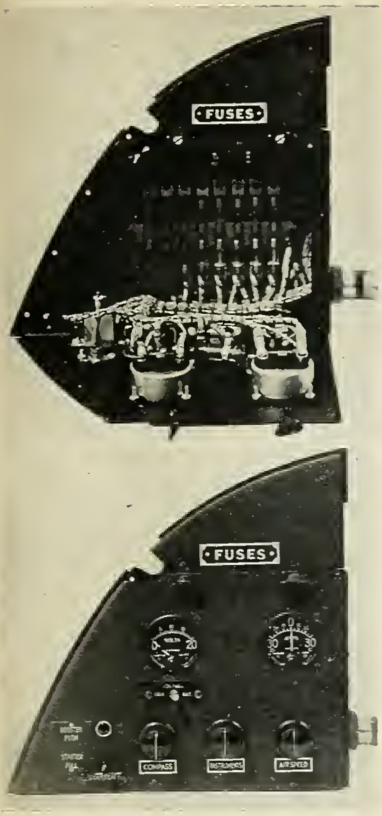


Fig. 2. Hinged left panel

ment vacuum check valve, and a switching valve. The vacuum check is a selector made from a Lunkenheimer three-engine primer valve which connects vacuum lines from the turn and bank indicator, directional gyro, and artificial horizon to the suction gauge. The suction on each instrument may be quickly checked by operating the lever to the desired position on the dial. Normally these instruments are connected to their respective venturi tubes. As a precautionary measure their readings may be checked by another source of vacuum which is produced by an engine driven suction pump. The switching valve shown connects to the selector through which readings on all three vacuum operated instruments may be taken and compared. By means of the switching valve, a reading taken by a venturi may be checked against the pump vacuum by operating the switching handle.

Instrument venturi tubes are mounted on the under side of each exhaust manifold and are protected against freezing by exhaust bleeder tubes.

The center instrument panel is a 3/16" sheet of Dowmetal into which threads are tapped to receive cadmium plated brass screws for holding the instruments in place. Threaded holes remove the necessity for nuts and washers which are difficult to reach when removing or replacing instruments. Plated brass screws are used instead of steel to eliminate magnetic effects and are cadmium plated to prevent electrolytic action.

All instruments are front mounted making them readily accessible. Wiring and line connections are accessible from the front after the instruments have been unloosened and pulled away a few inches from the panel.

A scientifically-designed indirect lighting panel, of 24ST Alclad, drop hammer stamping, is used and it reflects diffused light on instrument dials. Inside, it is finished in white glossy lacquer, the outside in flat black. Edges and holes are sealed against light escapement by felt strips. It is mounted on spacers attached to the main panel and spaced one inch from it. The depressed portions around the instruments are designed so that dials are fully visible to the pilot. Figure 4 shows the openings to be round at the dials and oval towards the panel surface in some cases. Such an arrangement provides excellent visibility as the angle of the rim is identical to that measured from the position of the pilot's eyes, horizontally and vertically.

Light is obtained from eleven 6-volt lamps distributed on the board in such a manner to adequately illuminate each instrument. Lighting panel rims are slighly spaced away from the dials so that light reflected by the white undersurfaces will be diffused onto the dials. This arrangement eliminates high lights or disconcerting bright spots of concentrated light. By means of the rheostat, lighting intensity may be varied at will.

A four point switch connected to Weston indicator enables the pilot to determine the temperature of the outside air as it enters the air conditioning system, temperature of cabin air, and the carburetor air temperature. Normally the switch is on the off position. Resistance bulbs are placed in the wing fresh air duct, on the cabin side wall, and in the carburetor intake throat. These bulbs are connected to a Wheatstone bridge circuit which is incorporated within the instrument.

Motometer Type R. K. D. fuel capacity gauges are provided, one for each right and left wing fuel tank. Below the fuel gauges on the instrument board are two position indicators, one for the retractable landing gear, the other for wing flaps. The dials are graduated to show quarter positions from *Up* to *Down*. These instruments are also Motometer electrical fuel gauges converted by simply changing the dial. They are actuated by rotating potentiometers which are synchronized to and operated by flap and chassis mechanism. Varying the circuit resistance through the potentiometer also moves the dial pointer.

At the bottom center of the panel are two warning lights, one for the pitot heater, and the other for fuel pressure. A green light tells the pilot that the pitot heater is on which is normal for flight. However, the heating element is turned off when the ship is on the ground to keep it from burning out.

The appearance of a red light in connection with the fuel pressure indicates a pressure drop which may be caused by pump failure or by stoppage in the fuel supply. Should a tank be drained, a switch may be made to another tank before the engine stops if the warning light is heeded in time. This safety device is operated by a Pioneer fuel pressure warning unit in the electrical circuit.

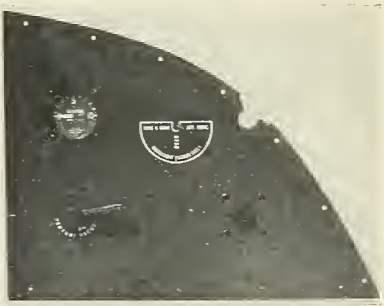
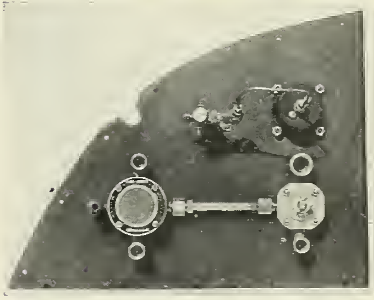


Fig. 3. Right auxiliary panel



For the pilot's convenience, a thumb operated push button is mounted on the control wheel for independent illumination of the airspeed meter. Connection is made from the wheel to the control column through a slip ring, making positive electrical connection at all times.

Considerable experimenting was necessary before a satisfactory method of mounting the panel was found. It was accomplished by a series of five studs attached to the panel which are inserted into specially designed rubber discs. The discs are secured to a transverse structural member in the fuselage which also supports the Lunkenheimer primer pump and heat control pull handles.

The rubber discs dampen vibration at the same time providing a sufficiently secure mounting for the panel. At low engine speeds on the ground the panel vibrates slightly but at cruising r.p.m. in flight, Sperry engineers were unable to measure more than .003" deflection from the normal position.

NEW EQUIPMENT and METHODS

Centrifugal Oil Sludge Separation

• ONE OF the most vital points on a radial air-cooled engine is the master rod bearing, and prevention of excessive wear at this point is important to dependable operation and low maintenance costs. Furthermore, the recognized importance of cleansing lubricating oil is attested to by the filters and strainers which are furnished to prevent foreign matter, which may have found its way into the lubricating system, from continually passing through the system and causing wear to bearings.

Conventional filters and strainers have their limitations in that they are effective in removing from the lubricating medium only such particles of carbon and foreign matter as are of sufficient size to be retained by filter discs or screens. Many small particles caused by the natural oxidation of oil are too minute to be caught, or are introduced into the lubricating system after the oil has passed through the filter which is usually located at the point where the oil enters the engine from the airplane's main oil tank. While these particles do no apparent damage, they do, over a period of time, contribute to wear.

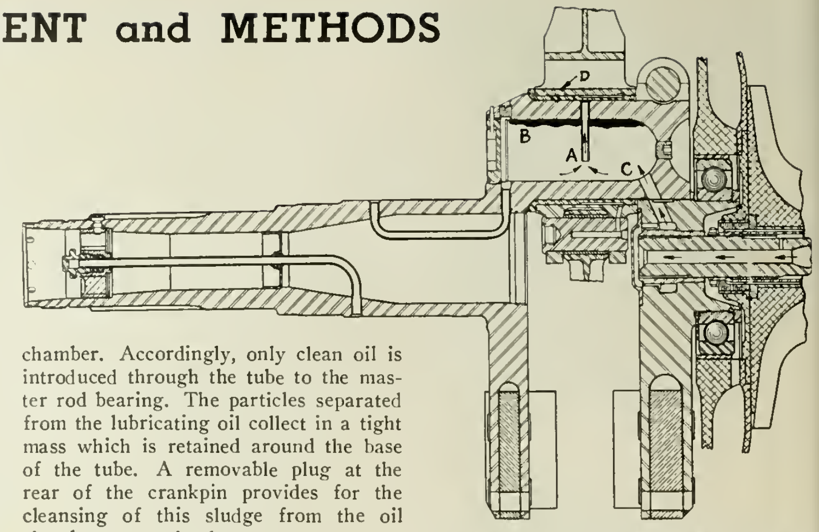
By utilizing centrifugal force, engineers of the Wright Aeronautical Corp. have provided in the crankpins of the Wright Whirlwinds and Cyclones, a sediment separator which removes smaller carbon particles from the lubricating oil before it reaches the master rod bearing.

The construction of the crankshafts of Whirlwinds and Cyclones, wherein the rear crankcheek is attached to the forward portion of the shaft without the use of a telescopic splined coupling, permits the provision of a large oil chamber inside the crankpin at no sacrifice of strength and rigidity. From this chamber, oil is fed under pressure to the master rod bearing. Normal practice would be to provide a drilled outlet through the wall of the crankpin from the chamber to the bearing. Instead, a small piece of tubing is fitted in the outlet, and extends from the outer wall of the crankpin down into the oil chamber to a point near the longitudinal axis of the crankpin.

When the engine is in operation, lubricating oil enters the oil chamber under pressure at an angle of approximately 45°, flowing against the inside of the crankpin wall above the opening of the tube. Centrifugal force created by the rotation of the crankshaft separates the heavier carbon particles and products of oxidation from the lubricating oil and forces them against the wall of the chamber. Accordingly, only clean oil is introduced through the tube to the master rod bearing. The particles separated from the lubricating oil collect in a tight mass which is retained around the base of the tube. A removable plug at the rear of the crankpin provides for the cleansing of this sludge from the oil chamber at overhaul.

During a recent endurance test with a Whirlwind 285 h.p. engine, under flight conditions, the engine was run for 400 hours without servicing, forced stops or adjustments. Oil was not changed at any time during test, a fresh supply being added as required to compensate for that consumed. Disassembly of the engine at the end of the test run revealed that the master rod bearing was in perfect condition; when the plug was removed from the crankpin and the oil pocket cleaned more than 2 ounces of sludge was removed. This sludge represented small carbon particles and foreign matter which had been deposited against the inside wall of the crankpin and prevented from passing through the master rod bearing by the sediment separator.

The accompanying illustration is a cross sectional view of the Cyclone crankshaft showing the crankpin oil chamber and the sediment separator; *A* is the separator tube, *B* sludge cake deposited on wall of chamber by centrifugal action, *C* oil inlet line to crankpin, and *D* the master rod bearing.



Cross section of Cyclone crankshaft showing crankpin oil chamber and sediment separator

2½-Pound Portable Electric Drill

• A SMALL, light-weight portable electric drill, weighing 2½ lbs. and delivering the same power as larger tools, has been announced by the Independent Pneumatic Tool Co., Chicago. This tool, the U-14 in the ¼" capacity and the U-13 in the 3/16" capacity, is half the size and weight of other drills of the same power, but will drill through ¼" thick steel in 5 seconds. It fits in one hand and serves equally well in production and plant maintenance.

Ball bearings, and machined heat-treated helical gears reduce noise and vibration and increase motor efficiency. These same features also reduce generated heat and the Thor ventilating system provides motor cooling.

The U-14 incorporates a hand wound armature, special commutator construction, plus other mechanical features associated with the Thor line.

Thor portable electric drill

Grease Cleaning Machines

• A SHORT while ago the U. S. Army Air Corps purchased several machines made especially for cleaning purposes. More recently the Naval Reserve bought seven machines of the same type, for delivery to air bases in various sections of the country. The versatility of these machines makes them useful to shopmen, maintenance men, and inspectors alike, for they may be utilized for cutting grease from engines, dirt from fuselages; removing oil and dirt from concrete runways; cleaning the walls, windows, and floors of buildings; disinfecting lavatories; and, by addition of suitable compounds, for stripping paint.

Known as Hypressure Jenny, this machine can be obtained in either stationary or portable rolling units. It is manufactured by the Homestead Valve Manufacturing Co., Coraopolis, Pa. Essentially its operation consists in discharging a heated chemical vapor spray from the nozzle of a manually controlled gun at high pressure.

Among several refinements of this machine is a control valve which causes the machine to start and stop without attention from the operator, at the same time maintaining within 10% predetermined vapor pressure. The cleaning solution strikes the surface to be cleaned in spray form, removes the dirt and grease; and both the temperature and pressure of this solution (which may be raised to 200°F. and 175 lb./sq. in.) are independently variable at the operator's will. A saturation selector also enables the operator to control the water content or vapor saturation of the spray independently of temperature and pressure considerations, as the particular work demands.

Impregnated Wood

• PYRATONE PRODUCTS Corp., Chicago has produced a process, using a synthetic resin of the phenol and formaldehyde condensation type, known as *Temp-Urd Wood,* which when introduced or impregnated into wood, is said to improve several of its characteristics.

In this process, the wood is maintained in a vacuum and then submerged in liquid resin. Pressure of several atmospheres is then introduced. The impregnated wood is then subjected to a cure of 200°F. for about 100 hours, giving uniformity of resin distribution throughout the treated wood.

Processes have been developed for training practically every article made of wood, the process depending on its ultimate use. In the construction members for airplanes *Temp-Urd Wood* combines to give hardness, abrasion and bending strengths, and resistance to moisture to the already present lightness and flexibility of the natural wood. The impregnation serves to harden the surface, thus affording a backing and eliminating the operation of filling the pores, or a primer coat. Lacquer and varnishes may be readily applied to the surface of the impregnated wood.

For articles where a high, glossy, durable finish is desired, a second application of the material is made, resulting in a transparent finish which brings out the natural grain of the wood. This second application remains on the surface because it is actually fused to the previously impregnated pores which terminate at the surface, and a firm body anchorage is secured. Thus a hard finish is produced, offering resistance to scratching and abrasion.

Static Crash Eliminator

• IN THE new 17-A radio receiver manufactured by the Western Electric Co., static crashes are automatically limited to unobjectionable values. While beacon signals come in with regular precision, heavy static crashes that might drown out desired signals are chopped off.

This receiving set is designed primarily for the private flyer, and has two frequency ranges: one covering the broadcast band, and the other, the beacon and weather bands. The entire receiver occupies little more than a third of a cubic foot, and the static eliminator is a cylinder measuring about ¾" in diameter and ¼" thick. It is called a varistor, and is shunted across the output circuit of the final vacuum tube through a condenser.

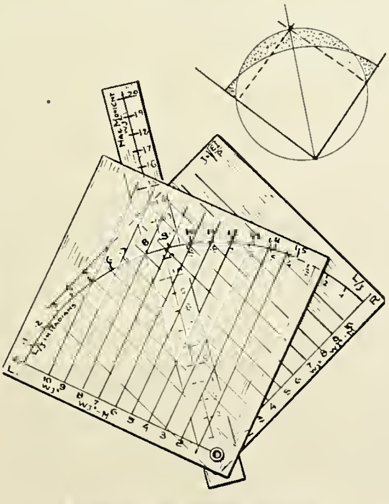
The word varistor comes from "variable resistor"—two words which describe its most significant characteristic, since its resistance varies with the voltage across its terminals. At the voltage at which the tube normally operates, the varistor has a high resistance and thus has little effect on the operation of the circuit. Over a narrow range of voltage, however, the resistance drops from extremely high to very low values. As a sudden increase of voltage comes with the static crash, the resistance of the varistor drops rapidly and the output of the tube is practically short-circuited for the duration of the disturbance.

The varistor is not intended to give perfectly quiet reception, but to eliminate the extreme discomfort caused by loud crashes, and its use makes it possible to get dependable signals under adverse conditions.

Beam-Column Calculator

• A NEW device for solving beam-column problems has been developed by Raoul J. Hoffman of St. Petersburg, Fla.

The accompanying sketch of the instrument is self-explanatory, as the principle of the device is based on the trigonometry of the circle, that each angle enclosed 90° between diametral points, to any other point of the circle.



Hoffman beam-column calculator

The small diagram in the corner of the sketch graphically illustrates the type of beam-column problem that can be solved by the use of this time-saving calculator.

Annunciator Units For Safety

• IN THE aviation industry where temperature, speed, precision, vibration, etc., are important factors in the manufacturing and operational processes employed, immediate action is demanded when normal operation is impaired if damage is to be avoided.

In this connection, annunciators are useful in quickly detecting abnormal conditions of plant operation especially for the supervision of automatically operated machines, or machines which, under normal conditions, require little supervision. These units have been adapted to show changes in pressures, liquid levels, speed, voltage, amperage, temperature, movement of bodies, vibration, flow and practically any other condition which should receive prompt attention at the first sign of abnormal operation.

In other words, it is a signalling or recording device which acts as a check on proper operation. Signal lamps can be arranged to operate from continuous contacts such as those occurring as a result of a rising liquid level or temperature change, or they can operate from momentary contact such as might occur in the case of a circuit breaker or other transient phenomena.

Annunciators may be operated from photo-cells and will monitor the operation of other equipment which is photocell controlled. Automatic counters may also be furnished to indicate the number of times any particular lamp is lighted, thus providing an authentic record of the frequency with which the observed condition occurs within a given period. Also, alarm bells may be made to ring continuously so long as the condition prevails, and may be silenced manually or automatically until again sounded by a repetition, reversal, or still another change in conditions under the supervision of the annunciator system. In other words, the possibilities of employing annunciators in industrial plants are limited only to the electrical engineers' ingenuity.

The Kellogg Switchboard and Supply Co. of Chicago, thru an intensive study of the applications of annunciator equipment, is in a position to make recommendations based on the practices adopted by leaders in the power, electrical and numerous other industries. Many circuit variations are available to meet practically any operating condition.

THE AIR SERVICES

Commanders at France Field Changed

LIEUT.-COLONEL Lewis H. Brereton, Air Corps, Commanding Officer of France Field, Panama Canal Zone, for the past three and one-half years, recently departed for the United States via Pan-American Airways. Col. Brereton has been assigned to the Command and General Staff School, Fort Leavenworth, Kansas, for duty as instructor, and reported at this school the latter part of August.

Lieut.-Colonel Junius H. Houghton, Air Corps, assumed command of France Field on June 20.

Third Transport Squadron Organized

A NEW organization of the Air Corps was established recently, known as the Third Transport Squadron, pursuant to War Department instructions, the unit became an active part of the Army at San Antonio on July 5, 1935. This organization takes the place of the former Third Provisional Transport Squadron, which had been in operation at the Depot as an embryo organization of the Air Transport Service instituted in February, 1933. This organization was commanded successively by Major R. B. Walker, Lts. D. F. Fritch and D. J. Ellinger, with a force of three enlisted pilots for airplane transport duty on detached service at the Depot from other stations.

On the date of the initial organization of the new Squadron, Captain J. P. Richter of the San Antonio Depot was assigned to its command.

Army Pilots Set Instrument Flight Mark

AUTHORITIES AT Hamilton Field, Army bombing base, announced the successful completion of a 400-mile instrument flying test which they say was the longest ever undertaken by Army aviators.

The flight, made by Captain Charles G. Williamson and Lieutenant Edwin W. Virgin, was from Hamilton Field to Clover Field, Santa Monica, Calif. The pilots used radio and flight instruments to guide them. Captain Williamson drew a hood over the cockpit immediately after the take-off, and it was not removed until they were ready to land.

Field Exercises by 91st Squadron

CLOSE LIAISON and cooperation with the Sixth Brigade, encamped near Monterey, Calif., with successful results, marked the two weeks' field exercises recently conducted by the 91st Observation Squadron, Crissy Field, with the 15th Photo Section attached. The base of operations was at Watsonville Airport, Calif.

During this period, observation, attack, bombardment and towing missions were flown. The annual tactical inspection by Major-General Paul B. Malone, Commanding General, 9th Corps Area, was conducted in connection with the performance of actual missions with ground troops.

New Class Reports at Advanced School

A TOTAL of 68 students, graduates from the Primary Flying School at Randolph Field, Tex., reported at the Advanced Flying School, Kelly Field, Texas, for the final four months of training, on July 1st. This class consists of 32 officers of the Regular Army, 33 Flying Cadets, and 3 foreign officers. This class is scheduled to graduate on October 15th, next.

Navy Unit Under Construction

CONSTRUCTION OF a new $14,000 shop at the U. S. Naval Reserve Aviation Base, Lambert-St. Louis Municipal Airport, is underway. Dimensions are 40 × 97 × 24 ft., and the building adjoins the large hangar. The shop will be built of brick and will house aircraft and engine overhaul equipment and a dope spray room. An additional $4,000 will be spent for equipment and interior construction.

Newest scout observation plane for the U. S. Navy, the Curtiss O3C-1

Foulois Retires As Chief

LEAVING BEHIND a record for the longest flying career in the Army, and a total service of forty-five years, Major General Benjamin D. Foulois retired last month as Chief of the Army Air Corps.

General Foulois, now on temporary leave, was granted an extension until December 22 when he reaches 64 years of age, and is automatically retired. His first flight was in a dirigible and in 1909 he was selected to take flying instruction from the Wright brothers when the government purchased its first military plane. In 1910 he was in Texas as head of the nation's air force, and when we entered the World War drew up plans for the organization of the A.E.F. air service which he headed.

Brig. General Oscar Westover will succeed General Foulois as acting chief of the Air Corps.

45 Basic Trainers Purchased

ASSISTANT SECRETARY of War, Harry H. Woodring, recently announced the award for 42 basic training airplanes; for spare parts, equivalent to 3 airplanes; and for certain data, to the North American Aviation, Inc., Dundalk, Maryland. The amount of the award totals $559,731.80, including cost of the spare parts, $36,300, and that of the data $15,231.80.

In accordance with the established practice of the War Department, the airplane for which the award was given was thoroughly tested by repeated flights. The plane is single engined with a maximum speed of 175 miles per hour, and with a service ceiling of 20,000 feet. It has complete radio installation, but no armament. It has a gross weight of 4150 pounds, of which approximately 1150 is its useful load, including pilot and student.

West Pointers Assigned to Flight Training

A TOTAL of 47 members of the class of 277 cadets who graduated from the United States Military on June 12, 1935, were, under recent orders of the War Department, directed to proceed upon the expiration of their graduation leave to Randolph Field, Texas, and report to the Commanding General of the Air Corps Training Center for duty and flying training.

These 47 students, or 17 per cent of the entire graduating class, received commissions in the various branches of the Army, except the Air Corps, as follows: Corps of Engineers, 4; Cavalry, 5; Coast Artillery, 4; Field Artillery, 14; Infantry, 20.

A year of flying training is ahead of these West Point graduates including an eight months' primary and basic course at the Primary Flying School at Randolph.

ACTIVITIES AT THE SCHOOLS

Enrollments Increase

DURING JULY, 24 students enrolled in the Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal, Glendale, Calif., marking the largest enrollment for any single month in the history of the Institute.

Eleven states and one foreign country were represented in the month's enrollment, and in enrolling the students it was discovered that the majority have from one to four year's college training although a high school education is all that is required for entrance in the Institute.

Applications for enrollments at Aeronautical University, Chicago, indicate that registration for classes beginning September 16 will increase the student body to a number larger than it has been since the school was founded. In the Aeronautical Engineering Course there are now 84 students and there are 39 in the Licensed Mechanics Course.

Schools Add Facilities

A WRIGHT Cyclone engine has been added to the equipment of the Mechanics' School at Parks Air College. Other equipment recently added to the Mechanics' Schools includes a Hamilton Standard controllable pitch propeller, portable buffing machine, master rod boring tool, electric riveting machine, and a compressor for pumping up shock absorbers. In addition a new Lambert Monocoupe was added to the school's flight training equipment.

Added to the extensive equipment at Stewart Tech, New York City, are a Pratt & Whitney Hornet 525 h.p., a Pratt & Whitney Wasp, 400 h.p., a Pratt & Whitney Wasp Navy Type 525 h.p., and a new Wright J-6-9 Model R-975.

New engine equipment has been added, and a complete sheet metal working department and a wind tunnel have been acquired at Aeronautical University.

Personnel Changes

DR. C. EUGENE BUELL will instruct in the Executive School, specializing in Meteorology at the Parks Air College of East St. Louis, Ill.

Additions have been made to the staff of instructors at Stewart Tech, New York, N. Y. H. E. Anderson, chief instructor, is now assisted by Ernest Curran, A. N. Treskin and James Weitzel.

School Activities

EXTRA-CURRICULA and scheduled activities in the various schools throughout the country have kept students busy throughout recent months.

Casey Jones School of Aeronautics students dismantled a Ford tri-motored transport which was on exhibition in the Pennsylvania Station and the Aeronautical Engineering Society of the school held its first dinner at Newark during which talks by C. S. Cain, TWA service manager, and Donald Parker of Pan American Airways, were made.

Opening the regular cross-country flights, instructors and students of the Spartan School of Aeronautics made a trip to Oklahoma City as guests of the Chamber of Commerce of that city.

Warren School of Aeronautics, Los Angeles, will admit selected students on a basis which will permit them to pay for training from wages when employed under a new financing arrangement.

Ryan students recently made a number of inspection trips which took them through the Lockheed and Douglas aircraft factories and to the Aircraft Carrier *Ranger*.

Since inauguration of a scheduled air transport line for instruction purposes, 11 Parks executive transport pilot students have completed their trips. The students operate their craft under the same conditions as if they were flying a regular air transport schedule.

FLY WITH THE DAWN PATROL

SPARTAN
THE MILLION DOLLAR SCHOOL OF AERONAUTICS

Enroll NOW
Send for the NEW Spartan Catalog

SPARTAN

Start today! . . plan for YOURSELF a definite place of leadership in the fast growing Aeronautical Industry. SPARTAN the ONLY MILLION DOLLAR Government Approved School of Aeronautics in the World—*offers you that place, with courses of instruction that leading today, prophesy YOUR future needs*—equipment and trained personnel PLUS a MILLION DOLLAR organization. Send for YOUR copy of the Spartan Catalog the most complete ever published, over 50 pages profusely illustrated listing in detail all courses and costs, equipment and budgeted living expenses while in the school.

SPARTAN OFFERS YOU THE MOST COMPLETE YET QUICKEST AND MOST INEXPENSIVE METHOD OF ENTERING THE AVIATION INDUSTRY!

THE MILLION DOLLAR SCHOOL OF AERONAUTICS

SPARTAN SCHOOL OF AERONAUTICS
P. O. BOX 2649, TULSA, OKLAHOMA

GENTLEMEN: Send me a copy of the NEW 1935 Spartan Catalog and Supplement describing in detail Spartan 3 ★ ★ ★ STAR Courses of Aeronautics, tuition prices and detailed living expenses:

NAME ____
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CITY ____ STATE ____
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Check below branch of aeronautics you are most interested in:

☐ FLYING
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☐ EXECUTIVE-MANAGEMENT

PRIVATE FLYING AND CLUB NEWS

Air Shows Attract Thousands

MORE THAN 50,000 people saw the show at the Paul Baer Municipal airport, Fort Wayne, Ind., for the joint benefit of the airport, the Aero club, and the American Legion. Thousands of visitors from surrounding cities attended to witness the races and stunt flying. Harold Newman won the 15-mile speed event in his Howard racing plane, with Joe Jacobs, also flying a Howard, second.

A four-hour show under the auspices of the Veterans of Foreign Wars at the lake front was the main event of Milwaukee's five-day centennial celebration's concluding program. The parade of planes was led by George Vest, Department of Commerce supervisor, in a Monocoupe, and Forrest Longeway, deputy federal inspector of aviation. They were followed by an Aeronca, three Bull Pups, two Fleet biplanes, a Kohler seaplane and a Pennsylvania Airlines Ford. Stunting and maneuvers were done by Elmer H. Leighton, chief instructor at Curtiss-Wright airport, and Walter Steiner, chief instructor of Midwest Airways.

Nearly 5,000 people witnessed the Flying Aces air circus at the Royal airport, Madison, Wis. The event was sponsored by the American Legion. Events included formation stunting, sky-writing and wing walking by Dorothea Aiken; a low altitude parachute jump by Billie Schultz; picking a handkerchief from the ground with the wing tip of a plane by Vincent Burnett; an acrobatic exhibition by Vern Christian; and a 10,000 foot delayed parachute jump by Jack Huber.

A crowd of more than 60,000 gathered at the Toledo Transcontinental Airport to witness an air show program sponsored by the Toledo *News Bee*. Featured were the Linco aces consisting of Lieut. Joe Mackey, Gordon Mougey, W. Myron Hightower, Bill Sweet, sports and air race announcer, Al Williams, Tom Mix, Col. W. D. Tipton, Edith Foltz and Irvin Davis, batwing parachute jumper.

Clubs Organized

DEDICATED TO furtherance of the best interest of aviation in the Badger State, members of the flying fraternity recently organized the Wisconsin Aeronautical Association, with a charter membership made up of 200 licensed pilots, student pilots, mechanics and operators. Organization of the group came about originally as a result of proposed legislation calling for an aviation commission and a director whose function was to be a duplication of the work of the Department of Commerce. Funds to carry out this program were to be set aside from a four cent tax on aviation fuel plus a weight tax of 1c per pound on aircraft. Members of the association so strenuously opposed the bill that it was killed. Officers of the new association consist of: Howard Morey, president; Al De Voe, vice-president and Max McCotter, secretary and treasurer.

A group of active Atoka, Okla., citizens have formed an aviation club to sponsor building of a hangar on the airport there. The club now has a membership of 14.

Personnel Notes

GOVERNOR R. L. Cochran has appointed the members of the Nebraska aeronautical commission created by the 1935 legislature. They are Dr. W. W. Arrasmith, C. J. Campbell, W. J. Hotz, W. S. Rodman, Jr., and H. W. Peterson.

Carroll D. Gietzen has been elected president of Civic Enterprises, Inc., subsidiary of the Omaha, Neb., Chamber of Commerce, which promotes the annual air races in Omaha.

AERONAUTICAL UNIVERSITY

Founded by Curtiss-Wright 1929

AU ACCREDITED

Government Approved—State Accredited

Get a real technical UNIVERSITY education in *less time, at less cost!*

Courses offered:

ENGINEERING

(B. S. DEGREE)

Licensed Mechanic
Pilot's Ground
Administration

U. S. Bureau of Air Commerce approved Airplane and Engine Mechanic's School qualifies you for Government Licenses.

MORE graduates working from this school than from any other commercial aviation school. Select the school of recognized superiority . . . that can give you the best and most training at reasonable tuition. The industry calls on us for trained men. Deferred payment plan. FREE placement service to students and graduates.
In the center of Air Transportation Industry where most of their main offices are located and near one of the world's busiest and largest airports.
Outstanding faculty. Complete modern equipment including Wind Tunnel. Fall Day and Evening classes now forming.

Get the facts about this foremost school of Aeronautics. *Write NOW for Free Catalog.*

AERONAUTICAL UNIVERSITY
Curtiss-Wright Building
Dept. A.D., 1338 S. Michigan Blvd. Chicago, Ill.

The Successful Sealing Compound For Aviation Use

★ *DEVELOPED FOR THE U. S. ARMY AIR CORPS*

fostoria TITE SEAL

STOPS LEAKS PERMANENTLY

OIL — GAS — WATER — STEAM — AIR

Throughout the aviation industry, Fostoria TiteSeal is the specified sealing compound for engine application. Originally developed for the United States Army Air Corps, Fostoria TiteSeal has completely provided a permanently leak proof sealing compound for the severe requirements of aviation use. Fostoria TiteSeal seals perfectly against oil, gas, water, steam and air. It will not dry out. It is indestructible. Heat and solvents have no effect. It grips tightly even under the most severe vibration. It will not shrink, crack or crumble. For every leak sealing requirement, Fostoria TiteSeal provides these exclusive advantages. It is the only successful material for aviation use.

NOW USED BY leading airplane motor manufacturers, air lines everywhere, and the United States Government.

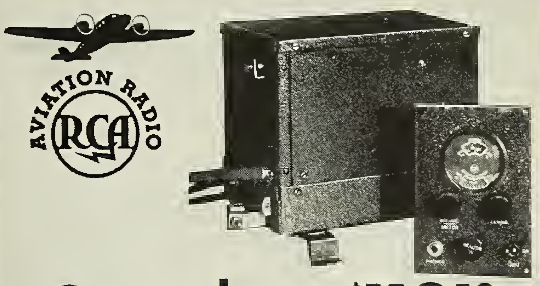
THE FOSTORIA PRESSED STEEL CORP.
Fostoria, Ohio

SEAL TIGHT WITH TITESEAL

Indestructible—Non-Hardening—Non-Solvent—Tight-Gripping—Heat-Proof—Vibration-Proof—Will Not Shrink, Crack or Crumble.

ALL THE SAFETY YOU COULD ASK OF A RADIO

—and it won't crash your pocketbook, either!



Complete $119^{50}

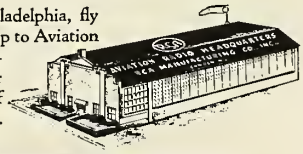
RCA Receiver, Model AVR-7 and 7A

HERE is the lowest-price aircraft receiver of proven merit. The price is for the complete receiver, including power unit, tubes, headphones, all accessories. Set is operated from the battery on your ship, either 6 or 12 volts. Two models are offered. AVR-7 offers the beacon and entertainment bands; AVR-7A, the beacon and communication bands. These receivers are backed by RCA's experience in every radio communications field, and will stand up in the roughest service. Extremely easy to install, extremely economical to operate. In tune with aviation today!

AVT-3A AIRCRAFT TRANSMITTER

Made to the same strict specifications, insuring reliability, and priced low. Complete in a single unit, including dynamotor power supply. Operates on any three pre-specified frequencies (selective in flight) between 2000 and 6500 kilocycles. Has 20 watts power, and permits you to transmit CW, modulated CW, or voice.

LAND HERE—When near Philadelphia, fly across the river to Camden and taxi up to Aviation Radio Headquarters at Central Airport. Your ship will be cared for while you inspect the complete line of RCA Aviation Radio Equipment.



For further details, demonstration or purchase, address:

AVIATION RADIO SECTION

RCA MANUFACTURING COMPANY, INC.
CAMDEN NEW JERSEY

AIRLINES AND AIR TRAVEL

New Bill Puts Lines Under I.C.C.

THE NEW air mail act setting forth revised regulations for handling the mail by airline operators and placing supervision over them in the hands of the Interstate Commerce Commission is now law.

The act authorizes designation by the Post Office Department of at least three primary routes instead of the former minimum of four, repeals the requirement that coastal routes be designated as primary, and sets up a standard requiring that primary routes be at least 750 miles long. Route mileage was raised from 29,000 to 32,000 and the total airplane miles flown yearly from 40 million to 45 million.

Air mail lines are now under the supervision of the I.C.C. which is directed to determine fair and reasonable rates for the carriers, but within the limitations of a 33 1/3 cents per mile maximum rate.

All-Expense Tours Arranged

THE FIRST all-expense tour ever announced by an American airline is a circle tour arranged by American Airlines to include major cities of the middle west and east. Transportation, hotel, and sightseeing expenses are included in a single ticket which carries the tourist more than 2,000 miles.

Starting at Chicago, or any city on the circle, the trip includes stops at Detroit, Buffalo, Boston, New York, Washington, Cincinnati and Indianapolis, returning to the starting point.

Sightseeing trips to the Detroit auto plants, Niagara Falls, the historic shrines of old Boston, New York's marts of commerce and amusement, Washington's governmental halls and scores of other places of interest in all these cities are included as part of the ticket.

Nine days are required for the trip.

Personnel Changes

ADVANCEMENT OF six co-pilots to first pilots, and the addition of ten new co-pilots to the staff of American Airlines was announced by Earl Ward, superintendent of traffic. This brings the total to 161 pilots and co-pilots. Former co-pilots promoted are: Dan Boone, Dan Lindsey, John L. Huber, C. C. Webrung, William J. Keasler and C. J. Brown.

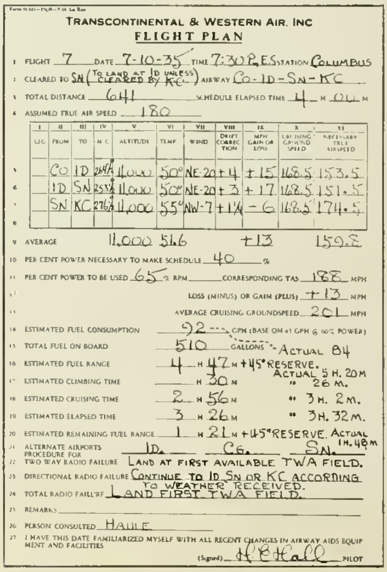
H. W. Peterson, district traffic manager for United Air Lines at Omaha, Neb., for six years, has become associated with Pan American Airways, Pacific coast division, in a similar position. He will headquarter at San Francisco. Clyde M. Sharrar, who has been assistant to the district traffic manager at Omaha for United, will succeed Peterson.

Following recent inauguration of the first night mail, express and passenger service between Dallas and Atlanta, Delta Air Lines appointed Air Lines Consolidated Ticket Office at 41 East 47 Street, New York City as Eastern Traffic Office with E. K. Smith as Eastern Traffic Manager. At the same time, announcement was made of the appointment of the Air Lines Consolidated Ticket Office at 636 South Olive Street, Los Angeles as their Western Traffic Office with A. R. Linn as Western Traffic Manager.

Radio Compass on Scheduled Transport Plane

THE FIRST transport plane in regularly scheduled service to include the Lear-O-Scope as standard equipment is a Douglas now operating on American Airlines transcontinental schedule, "The Southerner," between New York, Washington and Los Angeles.

The radio compass is designed primarily as a supplementary aid to navigation and will not supplant the regular magnetic compass and directional gyro which are now standard equipment on all transport planes. It will be particularly valuable in eliminating the possibility that a pilot, off the regular airway course, might not be able to establish contact with a government directional beam.



TRANSCONTINENTAL & WESTERN AIR, INC
FLIGHT PLAN

1 FLIGHT 7 DATE 7-10-35 TIME 7:30 P. E.S. STATION COLUMBUS
2 CLEARED TO SN (TO LAND AT ID UNLESS CLEARED BY KC) AIRWAY CO-ID-SN-KC
3 TOTAL DISTANCE 641 SCHEDULE ELAPSED TIME 4 H 00 M
4 ASSUMED TRUE AIR SPEED 180

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
	LEG	FROM	TO	M C	ALTITUDE	TEMP	WIND	DRIFT CORREC TION	MPH GAIN OR LOSS	CRUISING GROUND SPEED	NECESSARY TRUE AIRSPEED
5		CO	ID	264½	11,000	50°	NE-20	+4	+15	168.5	153.5
6		ID	SN	255½	11,000	50°	NE-20	+3	+17	168.5	151.5
7		SN	KC	276½	11,000	55°	NW-7	+1¼	-6	168.5	174.5
8											
9 AVERAGE					11,000	51.6			+13		159.8

10 PER CENT POWER NECESSARY TO MAKE SCHEDULE 40 %
11 PER CENT POWER TO BE USED 65 % RPM ____ CORRESPONDING TAS 188 MPH
12 LOSS (MINUS) OR GAIN (PLUS) +13 MPH
13 AVERAGE CRUISING GROUNDSPEED 201 MPH
14 ESTIMATED FUEL CONSUMPTION 92 GPH (BASE ON 61 GPH @ 60% POWER)
15 TOTAL FUEL ON BOARD 510 GALLONS - ACTUAL 84
16 ESTIMATED FUEL RANGE 4 H 47 M +45' RESERVE. ACTUAL 5 H. 20 M
17 ESTIMATED CLIMBING TIME ____ H 30 M " 26 M.
18 ESTIMATED CRUISING TIME 2 H 56 M " 3 H. 2 M.
19 ESTIMATED ELAPSED TIME 3 H 26 M " 3 H. 32 M.
20 ESTIMATED REMAINING FUEL RANGE 1 H 21 M +45' RESERVE. ACTUAL 1 H. 48 M
21 ALTERNATE AIRPORTS ID. CG. SN.
22 PROCEDURE FOR TWO WAY RADIO FAILURE LAND AT FIRST AVAILABLE TWA FIELD.
23 DIRECTIONAL RADIO FAILURE CONTINUE TO ID SN OR KC ACCORDING TO WEATHER RECEIVED.
24 TOTAL RADIO FAILURE LAND FIRST TWA FIELD.
25 REMARKS
26 PERSON CONSULTED HAULE
27 I HAVE THIS DATE FAMILIARIZED MYSELF WITH ALL RECENT CHANGES IN AIRWAY AIDS EQUIPMENT AND FACILITIES
(Signed) H C Hall PILOT

TWA flight chart showing estimated and actual figures for a recent flight

Trans-Pacific Mail Bids Asked

BIDS FOR trans-Pacific air mail service will be received at the office of the Second Assistant Postmaster General in Washington, D. C. until 12 noon, October 21, 1935, and the contract will be awarded as soon as practicable thereafter. The contract will be for a term of ten years beginning at a date optional with the contractor but not later than one year from the date of the award. The route, which is from San Francisco, Honolulu and Manilla to Canton and return, will carry mails of the United States, its possessions and of foreign countries.

It is stated in connection with the advertisement that service is being inaugurated for a more expeditious method of transporting mails over this route and to promote more friendly and better trade relations with far eastern countries. Accordingly a committee composed of the Secretaries of State, War, Navy and Commerce, together with the Attorney General, and the Postmaster General, will be formed to examine all bids. Upon the advice of the committee the Postmaster General will determine which, if any, bid should be accepted as well as other administrative action in connection with the award of contract.

Service will be once a week each way, and the schedule will require continuous flights over the route or as continuous as practicable. Day or night flying may be required. There are incidental provisions under which the frequency may be increased or reduced and under which the route may be changed to omit points or embrace intermediate points necessary for safety in operation or for postal purposes, also for suspension or discontinuance of service under certain conditions.

The specified load of mails provided for is 800 pounds with provision for carrying any excess mails offered. It is also provided that if the contractor voluntarily lands its aircraft at additional intermediate points on the route mail shall be carried to and from such points.

It is required that service shall be performed by multimotored seaplanes capable of sustained flight on 50% of engine power at 1,000 feet. The aircraft shall have a minimum cruising speed of 125 miles per hour; it shall have a fuel reserve sufficient to allow for a 30 mile per hour headwind, plus one hour; and it shall have a minimum capacity for six passengers. It is provided that after the initial four-year period of operation, if improved and more adaptable sea or land planes are available, the contractor may be required to reequip the route.

The advertisement is issued under authority of the Act of March 2, 1929, which allows a maximum rate of $2.00 per mile for the specified load and $1.00 per pound per 1,000 miles in excess of the specified load.

(Continued on following page)

PORTERFIELD
TWO-PLACE CABIN MONOPLANE

has decidedly more speed than any airplane under twice its price; other performance is comparatively the same. It is the only airplane in its price range which cruises over 100 miles per hour, and it lands about as slowly as any of them. It uses 3 gallons and 3 quarts per hour for student training and is an ideal student training plane. Cross-country, 105 miles per hour cruising speed is interesting. *Time payments.*

$1,795—A.T.C. No. 567

PORTERFIELD AIRCRAFT CORP.
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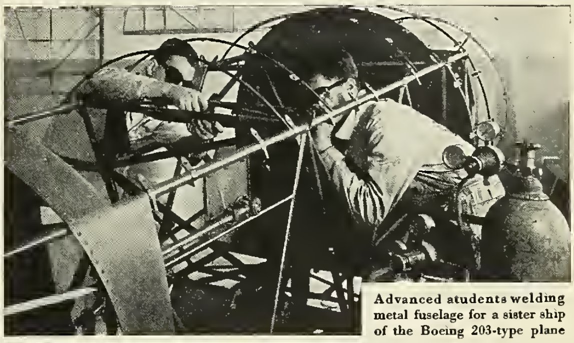

Advanced students welding metal fuselage for a sister ship of the Boeing 203-type plane

OUT OF ALL the air schools in America, Boeing School has over one-sixth of all the licensed ground instructors. Men with 10 to 24 years of experience in the industry.

In the shop and laboratory, the average is one Boeing instructor for every 5 students.

Equally outstanding are the 7 shops you work in: Radio, engines, woodworking, welding and metals, fabrication and design, instrument and maintenance.

In the engines shop, for example, you learn modern radial air-cooled engines through a study of 30 engines. Under the eye of licensed instructors, you overhaul and repair engines. Except in specialized instruction projects, you do not work with the obsolete types of power plants ordinarily used in aeronautical schools for instruction purposes.

As a division of United Air Lines, Boeing School is in day-to-day touch with the latest developments in air line construction and maintenance. You check the application of your school work with the actual practice in adjoining United Air Lines shops.

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Boeing School offers a complete range of courses—from a 9 months ground course at a tuition price of $600 and an amateur pilot course at $435, to the Boeing Airline Pilot and Operations course of 24 months duration ($5800)—the most thorough flight and ground training any school can offer.

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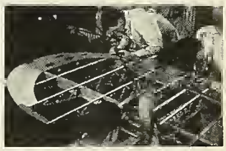

Checking parts for alignment. In addition to a wind tunnel, the Assembly and Repair Shop contains static and dynamic plane testing equipment ordinarily found only in airplane factories

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Division of United Air Lines

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☐ Airline Technician (Open to Engineering graduates)
☐ Airline Pilot and Operations
☐ Special Airline Pilot (For Transport Pilots only)
☐ Home Study Courses (For those employed in the industry)

Name__________ Age______
Years in High School__________ Years in College__________
Address__________ Phone__________
City__________ State__________

(*Continued from preceding page*)

Traffic Continues Increase

ACCORDING TO the Aeronautical Chamber of Commerce, the number of passengers carried in June represented another new monthly high; and for the first half of 1935 was 60.3 percent greater than for the same period of 1933. No comparisons are made with 1934, because greatly curtailed services at that time due to air mail contract cancellation would render such comparison meaningless.

Passenger-miles also showed a new monthly high, and the total for the first half of the year was over twice that for the first half of 1933. Express poundage was at another new monthly high, and for the first six months of the year was more than two and a half times that for the same period of 1933. Mail poundage for June was slightly under that for May, 1935, but the total for the first half of 1935 was 70.2 percent greater than in the same period of 1933. Miles scheduled and miles flown in June were higher than in May, and for the first half of 1935 were up 12.1 percent and 11.4 percent respectively.

Passengers carried during the first half of 1935 amounted to 367,357; passenger miles to 160,013,192; express poundage to 2,111,419 and mail poundage to 6,080,843. Miles scheduled were 29,017,520 and miles flown equalled 26,671,940. 14,355,421 gallons of fuel were consumed as well as 415,999 gallons of oil.

June figures show 81,559 passengers; 35,205,844 passenger miles; 487,537 pounds of express; 1,119,848 pounds of mail and 5,407,493 miles scheduled.

C. R. Smith, president of American Airlines, reflected additional evidence that travelers are taking more and more to the airplane as shown by the fact that American's July totals showed 19,498 revenue passengers carried, setting a new passenger record. Smith called attention to the fact that American's July record traffic represents a gain of 2,201, or 12.1 percent over the 17,297 revenue passengers carried in June. This is exactly 100 percent over the total of July last year.

In the seven months of 1935 a cumulative total of 96,428 revenue passengers traveled over American Airlines. Transcontinental and Western Air, and United Air Lines report proportionate gains for July. TWA reports that average distance traveled over its routes per passenger is greater this year than last.

Canadian Cities on Air Express Line

TWENTY CANADIAN offices of Railway Express Agency were designated export stations for the International Air Express service to Central and South America offered by Railway Express and Pan American Airways.

The new service permits shipments to be made between Canadian and Latin American points through the coordination of Canadian rail express, United States rail and air express and the international airlines that touch the Caribbean, and Central and South America. Shipments from the Canadian cities transported via this service travel through the United States via Railway Express Agency, which acts as a bonded carrier on both rail and airlines. At the international air terminals of Miami, Brownsville, El Paso, and Los Angeles, packages will be transferred to Pan American planes for delivery.

The following cities were designated: Nelson, Vancouver and Victoria, B. C.; Winnipeg, Man.; Brantford, Dunnville, Essex, Hamilton, London, Niagara Falls, Petrolia, St. Thomas, Tilbury, Tillsonburg, Waterford, Welland, Windsor and Ottawa, Ont.; St. Johns and Montreal.

Schedule Revisions

TRAFFIC SCHEDULES on the routes of American Airlines out of Dallas were changed recently, as were those of the New York-Chicago and Chicago-St. Louis divisions. On the New York-Chicago route, faster and more frequent services are offered, with three daily schedules to Chicago available. American is operating Douglas planes between the cities replacing the Condors on some of the runs. In addition, St. Louis was provided with five daily schedules to Chicago where connections can be made to New York.

Passenger, mail and express service of Boston-Maine Airways was extended to Bar Harbor every day in the week, increasing the formerly operated tri-weekly service. This arrangement will be continued for the summer months only, and will terminate September 30, when the line reverts to its old schedules.

Additional night service over the Atlanta-Dallas division of the southern transcontinental route was inaugurated by Delta Airlines, the planes leaving after midnight in both directions. Previously one plane each way was operated with an extra shuttle between Birmingham and Atlanta.

Schedule expansion calling for 50,000 miles of flying daily was inaugurated during July by United Air Lines with the addition of a sixth round-trip between Chicago and Salt Lake City, and eleventh round trip between Chicago and New York. Featured is a third round-trip schedule linking Los Angeles with Chicago, New York and other eastern cities by addition of another flight between Chicago and Salt Lake, and a new connecting schedule between Salt Lake and Los Angeles on Western Air Express. Further changes are planned for this month with United's re-equipment program nearing completion and enough of the Boeing 247-D transports ready for service to provide faster schedules west of Chicago.

Daily flights to West Yellowstone, gateway to Yellowstone National Park, are now offered by National Parks Airways, Inc., with each flight being part of the company's daily schedule operations between Salt Lake City and Great Falls, Mont.

The new service provides a round trip each day except Sundays and holidays between NPA cities and West Yellowstone. Air mail and express as well as passengers are carried on each flight.

Air passenger, mail and express service has been resumed at the Montpelier-Barre airport on the line of Boston-Maine-Central Vermont Airways between Boston and Burlington. Service there was suspended since January 1, because of the poor condition of the airport. Resumption of service provides direct connections between New York City and Montpelier-Barre in both directions by ships of American Airlines from East Boston, and to other points in the country.

New, fast 6-hour 40-minute service between Houston and Chicago and three round-trip schedules daily between Chicago and Kansas City were put into operation by Braniff Airways which received their seventh Lockheed *Electra* which enables them to extend the "Chicago Limited" service, which previously operated from Chicago to Dallas. By this extension, the service now links the six largest cities in the Middle and Southwest, and also gives a trip from Houston to Dallas in the morning. Under the new set-up, the Electras are now operated exclusively between Chicago and Kansas City.

Airlines Flying New Equipment

FIRST OF a fleet of Stinson tri-motored Model A Airliners was placed in operation on Delta Airlines July 1, connecting Dallas and Atlanta and also serving Shreveport and Monroe, La.; Jackson, Miss.; and Birmingham, Ala. The new service connects with American Airlines at Dallas for the West Coast and with Eastern Air Lines at Atlanta, south to Jacksonville and Miami, Fla., east, to Washington and New York City and north to Chattanooga, Nashville, Louisville and Chicago.

Heavy traffic on westbound planes has compelled Braniff Airways to replace the five-passenger planes that have been flying to Amarillo with ten-passenger Electras. Connections are effected with southbound Braniff planes and with planes to the east and west. The new ship leaves Dallas for Amarillo where connections are made with the night TWA plane for Los Angeles.

A new Vultee has been added to the service on the Dallas-Austin-San Antonio line of the Bowen Air Lines, and Eastern Air Lines has ordered five new Wright Whirlwind powered Electra transports for an overlapping or local and express service over its routes between New York and Miami, Chicago and New Orleans, and Chicago and Miami.

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THE 1935 PACEMAKER SERIES EIGHT

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AT THE AIRPORTS

Airport Improvements

EXCAVATION WORK is under way for the new Edward F. Booth, Inc., $40,000 hangar to be built at Love Field, Dallas. The new building will measure 215′ × 165′ and will be of hollow tile. Scheduled to be ready for occupancy in about two months, it will be one of the largest in the Southwest.

Doors will be electrically operated and of the canopy type, allowing entrance of the largest planes. The new unit will replace the one which was destroyed by fire last winter and will occupy the site of the former hangar, near the operating tower in the center of the hangar line at the field.

The Al Connick hangar at Felts Field, Spokane, Wash., is soon to be enlarged, and improved. It has long been the home of the Mamer Air Transportation Co., and is one of the largest commercial structures of its kind on the field. Of wood and corrugated iron construction, it was built about 1929. The enlargement and modernization program will be in accordance with requirements of the Department of Commerce for transport planes.

Installation of a radio compass approach system at the Buffalo, N. Y. airport will begin at once, according to Airport Director Nathaniel Duffy. The expense of the installation is being borne by the Federal government. The order for the installation was regarded in aviation circles there as indicating that the government is preparing to carry out the proposed $1,000,000 modernization of the airport. Officials explained that razing of the administration building was necessary before the beam could be installed for proper operation.

Approval has been given to the finished plans of the proposed administration building at the Cincinnati municipal airport to be erected on the site of the old administration structure. It will be 205′ × 75′ and include two wings, and will contain offices for air transport lines, weather bureau, radio control service, ticket offices, superintendent's office, baggage rooms and restaurant.

Eight Blind Approach Systems Arranged

RADIO TRANSMITTERS and lights to assist pilots in making blind approaches to the landing area when visibility is poor are in operation at Newark Airport, Newark, N. J., and construction of a similar system is nearing completion at Washington-Hoover Airport, Washington, D. C.

The Bureau already has arranged for the establishment of systems at Atlanta, Ga., Buffalo, N. Y., Cheyenne, Wyo., Indianapolis, Ind., Los Angeles, Calif. (municipal airport), and St. Louis, Mo., to the extent of actually leasing sites. Negotiations are under way for sites at a number of additional cities.

Equipment to be installed consists of two radio transmitting stations two miles and 1,500 feet distant, respectively, from the airport and in line with the principal runway, together with a number of lights on the ground leading to the edge of the field. An additional feature is a chain of lights flush with the ground and located along the principal runway of the airport to be installed by the airport management.

When visibility is poor, the pilot tunes his radio compass to one of the radio stations and flies to the vicinity of the airport. Upon passing over the transmitter a radio signal flashes on a light on his instrument panel. He then puts the aircraft on a line with the airport runway by flying between the two radio stations.

Having thus established his position, he begins the glide for a landing, locates the approach and runway lights and completes his landing in the normal and conventional manner.

New Quarter Opened

CONCENTRATION OF airline ticket offices in the Grand Central district of New York City was further emphasized by opening of a traffic office at 58 East 42 Street by United Air Lines. This makes the fourth ticket office in the heart of the mid-town business section of Manhattan, others being operated by TWA, American Airlines, and Pan American Airways. B. B. Gragg is temporarily in charge of United's office.

Activities of American Airlines and Bowen Airlines in Dallas have been moved to the northeast end of Love Field where the companies occupy the large hangar and office building formerly used by United Air Lines. The building has been reconditioned and facilities added for the comfort and convenience of passengers, including ample parking space for automobiles.

Chicago and Southern Air Lines, Inc., moved headquarters from Memphis to Lambert St. Louis municipal airport where it is occupying a large brick building offering hangar facilities and office space. The company is planning to construct its own radio station.

Eastern Air Lines also opened a ticket office in the Grand Central district of New York at 41 East 47 Street.

Private Lights To Be Rated

PRIVATE AERONAUTICAL beacon lights hereafter will be rated by the Bureau of Air Commerce, Department of Commerce so that airmen can determine from the letters in the rating symbol what type of light will be found at a given location and how effective it is.

Private lights include those maintained by airports, also airway, landmark and hazard beacons operated by private interests. The 600 or more private aeronautical lights supplement the assistance rendered to airmen by nearly 2,000 beacon lights on the Federal Airways System in this country.

A beacon light's designation and rating will consist of three characters. The first will be a capital letter showing the classification—*A* for airport, *B* for airway, *C* for landmark and *D* for hazard beacon lights. This will be followed by a number indicating operation—"1" for full time operation between dusk and dawn, or "2" for reliable part-time operation. The third character, a lower case letter, signifies suitability—*a* for a light which conforms to the prescribed standards based upon Federal Airways practice, and *b* for a light which is of lesser effectiveness, but is nevertheless a true aid to air navigation and which will not be confused with standard aids.

Thus an airport beacon light meeting the standards in full would be designated and rated A-1-a. The ratings will replace certifications of private aeronautical lights heretofore issued by the Bureau. Lights now certified will be carried in the records on the present basis until these certifications expire and are renewed. Upon renewal, ratings will be assigned in accordance with the new practice of the Bureau of Air Commerce of the Department of Commerce.

Airport Personnel

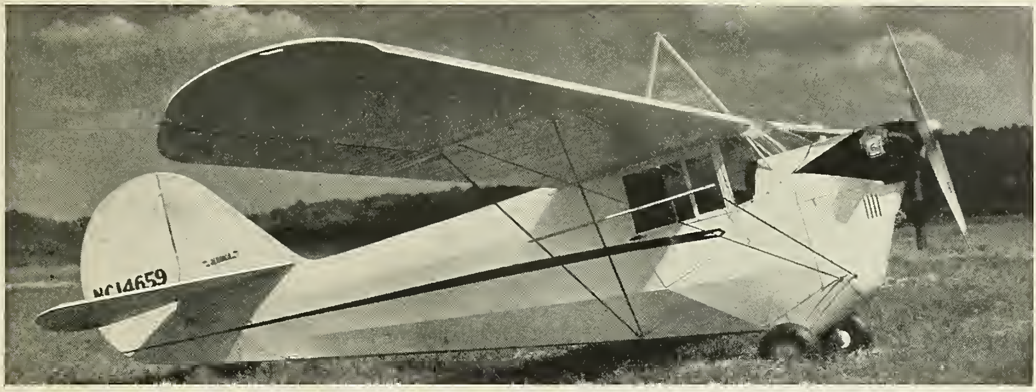
A FIVE-YEAR contract for the operation of the new municipal airport at Peru, Indiana, has been awarded to Grover Moore. Mr. Moore has engaged John Ruzicka as pilot in charge of flying activities and port operations and in charge of the flying school to be established there.

New Companies

UNITED AERO Corp., San Diego, Tex., has been granted a charter to deal in airplanes. Incorporators are Al. H. Turpe, C. D. Wallrath, and M. H. Fischer.

Newly incorporated at Spokane, Wash., is the Connick Air Service, Inc., which will operate aircraft. E. J. Connick, R. M. Lebisto, and W. W. Witherspoon are the incorporators.

For Flying Instruction—Aeronca Challenges America



EVERY light plane on the market today has some of the six factors that make Aeronca the ideal instruction ship, but *only Aeronca has all six!* *Economy*—¼ pint of oil, 3 gallons of gas per hour cruising. *Performance*—quick take-off, rapid climb, assured stability, whether the hand on the stick is student's or instructor's. *Easy Upkeep*—assured by Aeronca's simple design. *Ruggedness*—oleo landing gear, and structure that can "take it" even on those six-foot-high-landings. *Simplicity*—a ship that is "all airplane," yet easy for the student to understand and operate. *Resale Value*—as high after a year's service as the new price of many light planes. These six factors open up many avenues to profit for Aeronca-equipped operators. Find out today what Aeronca can mean to you. Write for the new folder, which gives full information and specifications.

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THE INDUSTRY IN GENERAL

June Exports $920,926

SALES OF American aeronautical equipment abroad for the first six months of 1935 reached $7,940,639 when returns from the Department of Commerce for June showed business during that month came to $920,926. The June total is somewhat of a let-down from the reports of the preceding month when $1,410,837 was recorded.

June business in foreign countries absorbed 16 airplanes and 42 engines, valued respectively at $214,816 and $173,340. Sales of parts and accessories amounted to $513,120 and of parachutes $19,650. June, 1934, business amounted to $894,655.

Sales in The Netherlands accounted for the largest number of planes—four, worth $160,936. In addition $47,304 worth of parts and accessories were sold in that country. Fourteen engines were sold in the Argentine Republic, bringing $63,800, and other sales consummated there were for $1,477 in parachutes, and $26,679 in equipment. One of the largest parachute shipments in some time went to Turkey which spent $10,303, and the Netherlands India bought $190,707 worth of parts and accessories and one plane to place it at the top in that category for the month in question.

Other countries in which aircraft were sold were: Brazil (3); Canada and Nicaragua (2 each); and one each in Italy, Guatemala, Union of South Africa and Hawaii.

Fifty-seven countries did business with American aviation companies during June.

Show Sales Total $270,000

DURING THE All-American Aircraft Show, concluded July 28 after a nine-day run at the Detroit City Airport, manufacturers reported $270,000 in sales of airplanes, engines and accessories.

More than 75,000 people visited the airport during the Show, of whom slightly more than 50 percent viewed the planes, accessories and engines in the exposition hangar. The others remained on the open portion of the airport to watch the flying activity on the field.

Attracting, perhaps, the most interest at the show was the TWA Douglas transport which broke many national and world's records with D. W. Tomlinson at the controls.

A new aviation group was assembled during the show period when a gathering of more than fifty licensed airplane pilots who have passed their fiftieth birthday, came to Detroit from twenty states and registered as charter members of the Over-50-Birds. Gar Wood was elected president with W. B. Stout, vice-president and Colonel J. G. Vincent, secretary and treasurer.

The leading unit number of the sales was reported by Ed Porterfield who sold eighteen monoplanes during the show period. Waco reported close to $40,000 in the sale of cabin and open planes. Continental Aircraft Engine company closed a $55,000 order for engines. Rearwin sold three planes off the floor and took away an additional half dozen prospective deals. Taylor placed six new distributorships, and Howard Ailor, representing Lear Developments, reported the sale of $14,000 worth of radio direction finders.

ASME Aeronautics Meeting Next Month

THE ANNUAL Meeting of the Aeronautics Division, American Society of Mechanical Engineers, will be held in St. Louis Oct. 10, 11 and 12. Major James H. Doolittle, Chairman of the Division, has arranged a program which includes approximately 40 papers by authorities in the country on their subject. A feature of the meeting will be the third presentation of the Spirit of St. Louis Award to the individual, not yet chosen, who has made the most generous contribution to the art and commerce of aviation during the past three years.

Orville Wright and Amelia Earhart will act as Honorary Chairman and Vice-Chairman of the meeting. In addition to the papers there will be an equipment and flying display at Lambert Field, a banquet, smoker, and other entertainment.

The Whirlwind-powered B17R Beechcraft equipped with a retracting undercarriage

Aircraft Licenses Increase

THERE WERE 14,177 pilots and 6,972 aircraft holding active Department of Commerce licenses on July 1, 1935, according to the Bureau of Air Commerce, Department of Commerce. On July 1, 1934, there were 13,722 licensed pilots and 6,541 licensed aircraft.

The total number of aircraft, licensed and unlicensed, of which the Department had record on July 1, 1935, was 8,883, while this number on the corresponding day of last year was 8,837. Unlicensed aircraft (bearing identification numbers only) totaled 1,911 on the first of July.

Among the 14,177 persons holding pilots' licenses as of July 1, 1935, were 7,132 transport, 828 limited commercial, 5,395 private, 717 amateur and 5 industrial pilots (new licenses no longer are issued in the industrial grade). The licensed pilots included 370 women classified as follows: Transport, 70; limited commercial, 25; private, 234; and amateur, 41.

Navy Buys 20 Trainers

CONTRACTS FOR the construction of 20 planes have been awarded by the United States Navy to the Stearman Aircraft Co. of Wichita, Kansas, a subsidiary of the Boeing Airplane Company. These primary training planes will be built for the Navy at a cost of $150,373.

The Navy trainer, known as the NS-1, will be of the same type as 41 already being built at the Stearman plant for the Navy under a contract awarded last year. The first of the new Navy planes will be delivered by October 30 and the balance by February 15, 1936. Deliveries on the 26 Army Air Corps planes recently ordered will begin approximately six months after the contract date.

North American Moves Factory

NORTH AMERICAN Aviation, Inc., affiliate of General Motors Corp., has leased 20 acres at the southeast corner of the Los Angeles Municipal Airport on which to erect an airplane factory.

Construction of factory and separate administration building will get under way about September 1. J. H. Kindelberger, president of the company, stated that the factory will be of steel construction throughout, external surfaces of stucco, the first unit of which will contain 150,000 square feet of floor space. A two-story administration building will be built separately.

"We expect to get into operation with a force of several hundred men before the end of the year," said Mr. Kindelberger, "on the production of some $1,200,000 worth of Army and Navy business including a contract for 45 basic training planes recently awarded by the Army."

(*Continued on following page*)

IRVIN Comfort de Luxe

yes, the time has come when the seats you fly in should match the comfort of the seats you sit in, at home.

- Irvin Chair Chutes give cabin planes this new luxury, and in the color scheme you prefer.

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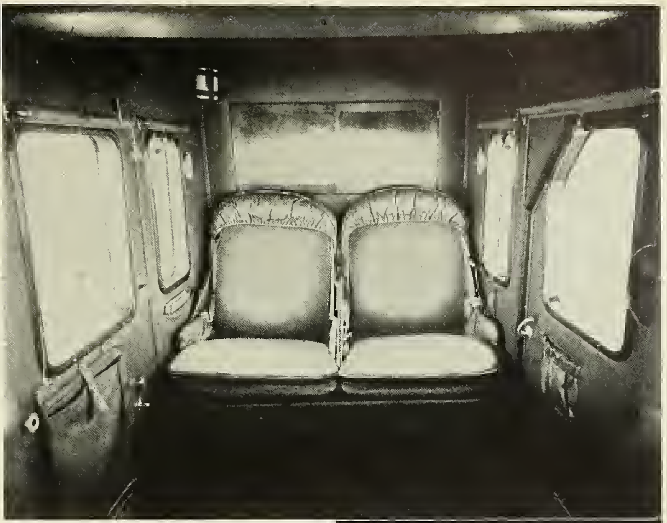
- This feeling in flying is truly comfort de luxe for Irvin Chair Chutes embody all of the essential features of standard Irvin parachutes that have saved over 1,000 lives in emergencies.



Rear seat of 1935 Bellanca Senior Skyrocket with its club chair comfort of Irvin Chair Chute installation.

For your ship, ask now about Irvin Safety Equipment—

IRVIN Air Chute
The Life Preserver of the Air

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combined with always ready IRVIN Safety Chair Chutes

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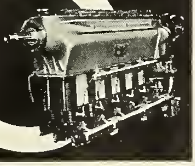

LAIRD PLANES

LAIRD Speedwing	Wasp Jr. 400
LAIRD Whirlwind	Wright J-6 300
LAIRD Whirlwind	Wright J-5 220
LAIRD Speedwing Jr.	Ranger 120
STINSON Reliant	Lycoming 210
WHIRLWIND J6-9	330 h.p. engine
WHIRLWIND J6-5	165 h.p. engine

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AIRPLANE COMPANY, INC.

(*Continued from preceding page*)

Approved Type Certificates

THE BUREAU of Air Commerce, Department of Commerce, recently issued the following approved type certificates.

Cessna Aircraft Co., Inc., Wichita. Model C34, four-place closed land monoplane powered by a Warner Super Scarab engine (145 h.p.).

Rearwin Airplanes, Inc., Kansas City, Model 7000, two-place closed land monoplane powered by a LeBlond 5DE engine (70 h.p.).

Waco Aircraft Co., Troy, Model CUC, four-place closed land biplane powered by a Wright R-760E engine (250 h.p.).

Fairchild Aircraft Corp., Hagerstown, Model 24C8-D, three-place closed land monoplane powered by a Ranger 6-390B engine (145 h.p.).

Beech Aircraft Corp., Wichita. Model Beechcraft A17FS, three-place cabin biplane powered by a Wright Cyclone SR-1820-F-3 engine (710 h.p.)

Bellanca Aircraft Corp., New Castle. Model Pacemaker 31-42, one- or eight-placed cabin monoplane, powered by a Wright Whirlwind R975E-2 engine (420 h.p.)

Beech Aircraft, Model Beechcraft B17R, four- or five-place cabin biplane powered by a Wright Whirlwind R975E-2 engine (420 h.p.)

Stinson Aircraft Corp., Wayne. Models Reliant SR-6B and SR-6C, four-place cabin monoplanes, powered by a Lycoming R-680-5 engine (260 h.p.) and a Lycoming R-680-2 engine (240 h.p.) respectively.

Scintilla Building New Unit

SCINTILLA MAGNETO Co., Inc., has recently placed contracts for a new factory building measuring 100 ft. by 280 ft. and a second unit of 35 ft. by 100 ft., adding approximately 31,500 sq. ft. to its present plant at Sidney, N. Y. These additions will considerably increase the company's facilities for the manufacture of Scintilla aircraft magnetos and battery ignition as well as Bendix automotive and industrial magnetos. Part of the new space will be devoted to the manufacture of Bendix H-T spark plugs and the facilities of the recently purchased Hurley-Townsend Corp. will be transferred to Sidney for this purpose.

Buffalo Seeks National Air Race

THE AERO Club of Buffalo has prepared a list of about 200 civic leaders to whom letters will be sent immediately urging their support of a proposal that Buffalo be included in a circuit of three or five major cities in which the National Air Races would be held in succeeding years.

The letters, sent by E. Howard H. Roth, vice-president of the Aero Club, solicit subscriptions to a guarantee fund. Mr. Roth said a minimum $50,000 would have to be raised for prizes and an additional sum of about $25,000 for capital. The Aero Club has sponsored, through Buffalo Air Races, Inc., races similar to the National Air Races, and Mr. Roth said the municipal airport is large enough for the national event.

Airship Exams Standardized

APPLICANTS FOR lighter-than-air craft pilot licenses hereafter will be required by the Bureau of Air Commerce, Department of Commerce, to pass standard examinations so that requirements will be uniform and in harmony with other classes of licenses now issued.

Present holders of letters of authority as licensed lighter-than-air craft pilots and all future applicants for this license will be required successfully to accomplish the following examinations: physical, flight check, and written work in navigation, meteorology, engines, and Air Commerce Regulations, including Air Traffic Rules.

Commercial Production Increases

AIRCRAFT AND aircraft engine production and delivery reports issued by the Aeronautical Chamber of Commerce for the month of May, 1935, show commercial production value was nearly twice that for May, 1934, although only 10 per cent more units were produced this May. Transport planes produced represented 78.6 per cent in value, and 11.7 per cent in units, of the total commercial production in May, 1935.

Commercial engine production value was 18.8 per cent less than in May of last year, and the number of units was 10 per cent greater, reflected in a 30 per cent decrease in average value. Military airplane production was about 60 per cent less in value, and 85 per cent less in units as compared with May, 1934. Military engine production in May, 1935, was about 33 per cent greater in value and 27 per cent greater in number of units. There was a slight increase in unit value. Military deliveries showed about the same relationship as production, comparing May, 1935, with May of last year.

During the month a total of 110 aircraft and 253 engines were produced for commercial and military purposes. Deliveries during May were 105 aircraft and 926 engines.

For the first five months of the year there were 347 commercial and 133 military planes produced.

Arrow Plans New Plane

PLANS ARE being completed by the Arrow Aircraft & Motors Corp., Lincoln, Neb., for the production of the two-place, low-wing monoplane, powered by a Ford V-8 engine, the first of which was recently sold to the Bureau of Air Commerce. According to F. Pace Woods, general manager, the plane has side-by-side seating arrangement, dual brakes, tail wheel, and is equipped with flaps.

(*Continued on following page*)

Digest of Recent Events

Two Remain Aloft For 56 Hours in Balloon

TWO SOVIET balloonists, Boris Romanoff and André Babrishkin, laid claim to a world record for flight duration in a balloon of 1600 cubic meters capacity by remaining in the air 56 hours. The previous mark was 51 hours set by Thomas G. W. Settle and Charles W. Kendall of the U. S. Navy at Chicago, in September, 1933. The Russians covered 350 miles during their stay in the air, ascending at Moscow and landing at Chuvash. AUG. 4

Arnoux Betters Own Light Plane Speed Mark

A NEW world's speed record for light planes was established by Maurice Arnoux when he covered a 100-kilometer course at Etampes, France at an average speed of 295.792 miles an hour, an attempt which bettered his own mark. He still holds the speed record for a 1000-kilometer flight at 292.825 k.p.h. (182 miles an hour) set last month. AUG. 10

S-42 Crosses Pacific In 17-Hour Flight

COMPLETING HER third westward crossing of the Pacific Ocean from Alameda, Calif., the Pan American Airways' Sikorsky S-42 landed at Honolulu with a new record for the trip. Seventeen hours 12 minutes after leaving the mainland, the four-engined flying boat, under the command of Capt. R. O. D. Sullivan, landed in Honolulu, clipping 33 minutes from her previous best time. An average speed of 140 miles an hour was maintained for the 2408-mile flight which was made to gather more engineering data for establishing the Pacific air route which will extend to Canton, China. The second stage of the flight was accomplished three days later when the plane landed at Midway Island, and prepared to make the first hop to Wake Island, next in the series of stops across the Pacific. AUG. 10

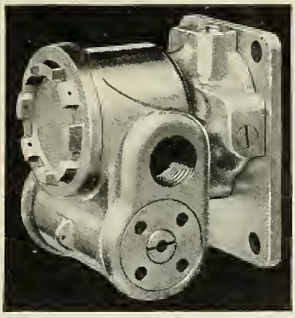
Elly Beinhorn Flies 2230 Miles In Day

THE DISTINCTION of being the first person to fly from Germany to Istanbul, Turkey in one day fell to the lot of Elly Beinhorn, German aviatrix who took off from Gleiwitz, Silesia for a flight to the Turkish city. After her arrival there, she started her return flight to Tempelhof airdrome in Berlin a little more than an hour after landing. Her total flying time for the 2230 miles was 13 hours 15 minutes, in a Taifun model manufactured by the Bavarian Aviation Works. AUG. 13

Boeing Bomber Speeds 2100 Miles In 9 Hours

AVERAGING 233 miles an hour, the new Boeing Bomber 299 built by the Boeing Aircraft Corp., for the U. S. Army Air Corps bomber competition, flew from Seattle to Wright Field, a distance of 2100 miles in 9 hours. The flight was made without stops, at an altitude of 12,000 ft., where the four P. & W. Hornets were delivering 65% of their total available 2800 h.p., and resulted in a new world's speed record for multi-motored, load-carrying craft of comparable size and weight. AUG. 20

FLIGHT SECURITY



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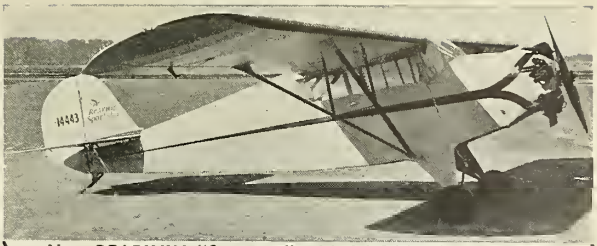

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(Continued from preceding page)

Personnel Notes

DR. JEROME C. Hunsaker, head of the Aeronautical and Mechanical Engineering Departments at the Massachusetts Institute of Technology, has become technical advisor to the United Aircraft Manufacturing Corp. Dr. Hunsaker, who was formerly vice-president of the Goodyear Zeppelin Corp., assisted in the establishment of and was an original member of The Bureau of Aeronautics, Navy Department, in Washington. As a Commander in the Construction Corps during the war he was in charge of the design of all Naval aircraft at that time, and he has been actively associated with all phases of the aircraft industry since that period.

Howard C. Stark has been appointed to the staff of the Bureau of Air Commerce, Department of Commerce, as an airline inspector. Mr. Stark's examinations of airline pilots and aircraft will be concerned largely with instrument flying, and instead of being assigned to a particular section of the country, he will be available for duty wherever special attention to this phase of airline operation is desirable. Much of his time will be given to smaller airlines which do not have full-time instrument flying instructors.

Amelia Earhart, who was employed by the Bureau of Air Commerce, in March of this year, at one dollar a year, tendered her resignation in order to be free to pursue her commercial aviation activities.

City councilmen of Dallas, in an effort to obtain additional recognition of their city as an aviation center, selected seven members for the newly created aviation committee that will assist the city government in this field of activity. These men are Col. William E. Easterwood, Jr.; Dr. L. E. Hamilton; Dr. C. J. Weiland; Herman E. Nesbit; H. S. Cherry; R. Newton Hollifield and Ernest R. Tennant.

Walter R. Jones, for 12 years associated with Boeing Aircraft Company, including engineering works, has joined the Kellett Autogiro Corp. of Philadelphia as design engineer and assistant to R. H. Prewitt, Chief Engineer.

Jones more recently organized the Aeronautical Engineering Department at Oregon State College and left a position as head of this department to join Kellett.

Announcement has been made of the appointment of James R. Fitzpatrick as director of sales of the Technical Division of Algoma Plywood and Veneer Co., Chicago, Ill. Fitzpatrick is known in the industry through his work with the Haskelite Manufacturing Corp., having recently resigned as vice-president in charge of sales.

Modern Craft Feature Longevity

THERE ARE at least 169 civilian airplanes now in service in this country which were built in 1926 or before, according to the Bureau of Air Commerce, which reported that the useful life of an airplane frequently exceeds five years.

Studying the licensing records as of June 1, 1935, the Bureau found that there were 8,733 civilian airplanes, of which 5,841 were licensed and 2,892 were unlicensed but bore identification marks.

Of the total, 4,207 were produced prior to 1930, and were still in service on the date used as a basis for the survey. Airplanes produced in 1930 or thereafter and still licensed or identified on the date of the survey numbered 4,155.

Business Reports

CONSOLIDATED AIRCRAFT Corp. reports net income for the first half of the year of $276,143 after expenses and other charges. Gross sales amounted to $2,706,536, of which $2,129,398 were sales to the United States Navy and $443,113 were commercial and export. In addition to the usual depreciation charges, $40,419 was deducted from income and charged to a special reserve in connection with guarantee provisions of certain contracts and the account for airplane design rights was reduced by a net amount of $49,878. No comparison with the corresponding period of 1934 is available. Current assets on June 30 amounted to $1,584,164 and current liabilities were $164,350.

Heavy business thus far in 1935 has led to an increased dividend rate on the common stock of the Irving Air Chute Co., Inc. The stock, formerly on an annual 40-cent rate, was placed on a 60-cent basis, according to George Waite, president. Earnings for the first half of the current year totaled $170,276.21 compared with the corresponding 1934 period figure of $22,795.77. The total for the entire year 1934 was $119,799.

Net profit of United Aircraft Corp. for the quarter ended June 30, 1935, was $177,913.64, equivalent to 8 cents a share on 2,087,532 shares of capital stock, which will be outstanding when exchanges of United Aircraft & Transport Corp. common stock have been effected. A loss from operations amounting to $23,897.53 was offset by other income. Total net profit for the six months ended June 30, 1935, amounts to $253,429.71, equivalent to 12 cents a share.

Plane Sales

SELLING ACTIVITY continues at a good pace as reports—from various sections of the country show numerous deals closed for new craft.

Taylor Aircraft Corp., Bradford, Pa., reports 19 sales of their Cub during the month of June, including one for export purposes; and Beech Aircraft Co., Wichita, Kans., sold six planes and appointed Mouton and Six of San Francisco Airport distributors for northern California.

Other sales reported were a cabin Waco to Emilio Sanchez of Cuba, and to Harry Richman, the stage star; a Ryan S-T to W. M. Miller of Cloquet, Minn.; a Boeing executive model to Phillips Petroleum Co. of Bartlesville, Okla.; a Ranger-powered Fairchild 24 to E. S. Penney of New York City, and a Stinson Reliant to Gannett Publishing Co. of Portland, Me.

Thompson Bros. Balloon and Parachute Co., reported the purchase of 21 freight chutes by the U. S. Forestry Service, Department of Agriculture in Ogden, Utah.

COMING EVENTS

The 1935 National Air Races will be held at the Cleveland Municipal Airport under the direction of Cliff and Phil Henderson. Aug. 30-Sept. 2

•

Results of preceding Regional Airport Meetings will be discussed in Birmingham, Ala. Sept. 7

•

Third Annual Air Show, under the auspices of the Junior Chamber of Commerce, will be held at Boeing Field, Seattle, Wash. Sept. 8

•

The Aero Club of Buffalo will again sponsor a series of air races at Buffalo, N. Y. Sept. 7-8

•

The Sixth Annual Coffeyville, Kans., Air Meet and Air Races will be held at the Coffeyville, Municipal Airport. Sept. 8

The Fifth Annual Meeting of the National Association of State Aviation officials is scheduled Detroit, Mich. Sept. 26-28

•

The Fourth Anniversary Celebration of the New Haven, Conn., airport will be held there, featured by a race and stunt program. Oct. 6

•

The 1935 National Technical Meeting of the ASME will be held at the Hotel Chase, St. Louis, Mo., under the sponsorship of the St. Louis section of the ASME. Oct. 10-12

•

The Eighth Annual All-American Air Races will be held at Miami, Fla. Dec. 12-14

•

An International Aero Exhibition will be held in Stockholm, Sweden. May 15-June 1, 1936

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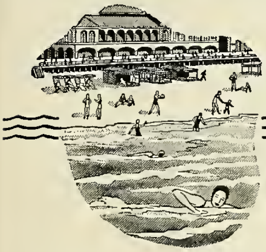

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FOREIGN NEWS IN BRIEF

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Australasia

IF PRESENT plans are adopted for the defense of Australia, the Royal Australian Air Force will possess in two years six fully equipped fighting squadrons, comprising more then 100 planes. Eighteen new Hawker *Demons* have already arrived, and orders have been placed for 36 more of the same type. The Air Board has asked the Council of Defence to approve the purchase of another 36 to accelerate the three-year plan of development begun in July 1934.

Almost 200 mechanics and 11 qualified pilots have joined the Air Force since January, and it is estimated that by June 1936, there will be 100 more fully trained pilots than there are at present.

WITH SIR CHARLES Kingsford-Smith as Governing Director, Trans-Tasman Air Service Development Co., Ltd., has been registered, with the object of inaugurating an experimental two-way mail service between Australia and New Zealand. The proposed service would be established for three or six months, using either a Martin or Sikorsky flying boat, or, carrying mails only, a Douglas transport.

KNOWN AS Air Center, a new organization has been formed in Sydney to promote all branches of civil aviation. Information regarding the latest aviation activities and developments in all parts of the world, maps, books, and advice on landing grounds are available to pilots. A market for second hand aircraft, which is something new in Australia, has also been created.

STATISTICS MADE available by the Civil Aviation Department show that for the three years ended last December, 12,273,241 passenger miles were flown, with only three accidents involving the death of one passenger.

For the first three months of the present year, 1762 flights were made with 2852 passengers over a distance of 296,489 miles without accident.

HOLYMANS AIRWAYS Pty, Ltd., plan extensions to their passenger service, to include a twice daily service between Melbourne and Hobart, and a daily service between Hobart and Sydney, via Melbourne and Canberra, the latter commencing on the seventh of next month.

NEW ENGLAND Airways, Ltd., has extended its service between Sydney and Brisbane to Townsville, the flight taking about seven hours, the return flight being made the following day. The six-day-a-week service between Sydney and Brisbane has been extended to seven days a week, and the purchase of the Larkin aircraft factory in Melbourne has been completed.

BI-WEEKLY K.L.M. service between Batavia and Amsterdam, which commenced on June 12 has been so arranged that the Dutch plane will leave Batavia 50 minutes after the Qantas-Empire Airways plane arrives from Brisbane, thus permitting a passenger to make the journey to London in 5½ days.

A NEW record for the trip between Bega and Sydney was made on June 17 when an Adastra Airways plane flew the 210 miles in 1 hour 18 minutes.

THE FEDERAL Government has announced the purchase of Sir Charles Kingsford-Smith's monoplane *Southern Cross* for £3000. The ship will be placed on exhibition, and has been acquired for the nation.

AUSTRALIA'S AIR mail has so greatly exceeded Government estimates on which the present Brisbane-Singapore section was based that it may shortly be necessary to increase frequency or use larger planes. It is understood that the mail now averages 520 lbs. a week inward to Darwin and 450 lbs. outward; original estimates provided for only 300 lbs. of mail being carried at this stage. In the DH 86's, which carry 10 passengers, mail occupies the space of four or five passengers on the internal section between Brisbane and Darwin, and of 7 passengers on the Timor section, on which a heavier load of fuel is carried.

OWING TO increasing tourist demands, bi-weekly service between Cairo and Jerusalem has been changed to daily round-trip schedules by Misr Airwork. Under the new arrangement three flights daily each way will be maintained between Cairo and Alexandria, on a 1 hour 50 minute schedule.

Over the new Alexandria-Palestine route, daily return service will be operated from Alexandria to Assiout via Mehalla Kobra, Port Said, Cairo and Minieh. This service will be timed to connect with the Cairo-Palestine planes both east and west bound at Port Said. Flying time between Alexandria and Jerusalem is 2 hours 30 minutes, compared with a 17-hour train trip.

DURING THE first month's operation of East Coast Airways, Ltd., the initial commercial air service of New Zealand, 96 trips were made and 288 passengers carried; flying time occupied 93½ hours, and the total miles flown was 9,391. Service was inaugurated April 16 between Napier and Gisborne, two important centers on the east coast of the North Island which have no rail connection. The company is operating two DH *Dragon* airplanes.

Czechoslavakia

AVIA, a subsidiary of the Skoda Works, recently completed the construction of a new high wing cantilever monoplane, powered by a Hispano Suiza 12-cylinder, water-cooled engine developing 650-860 h.p. While primarily designed for transport it can be converted into a day bomber or reconnaissance plane.

Materials used in the construction include duraluminum and steel, riveted, bolted and welded. To insure against corrosion, paint, lacquer and cadmium plating have been utilized. The fuselage and leading edges of the wing are covered with duraluminum, the rest of the wing by fabric.

The cabin accommodates 6 passengers. Individual ventilation is provided for each and the air is conducted into the cabin through ducts built inside the streamlining between the wing and the fuselage. The cabin is insulated against temperature, vibration and noise by double walls with air space between.

Performance figures show a maximum speed of 223 m.p.h. at 13,123 ft., a cruising speed at the same altitude of 186 m.p.h. and a range of 621 miles.

Canada

AIR MAIL routes were inaugurated last month to new outlying mining territories. On August 15, service was started in northwestern Ontario from Kenora to McKenzie Island and Red Lake, several hundred miles north of the railway. On September 1 service was started from Fort Chipewyan on the Arctic air mail route to Goldfields, Saskatchewan, adding another branch to the most northern air mail on the continent, and serving a region which before the

(*Continued on following page*)

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(*Continued from preceding page*)

coming of the air mail only received its mail once or twice a year. Both mails will be carried at no additional charge above ordinary first class rates, since they are the only mail service into these points.

To celebrate the 150th anniversary of the founding of Sydney, Nova Scotia, an experimental air mail service with special cachets was flown once daily between Sydney and Halifax from July 29 to August 3. For each of the twelve flights a different cachet was used. Operation of this service is interpreted as a move to resume the inter-city air mail service in the Dominion.

THE DEPARTMENT of Interior, on recommendation of the National Defence Department, plans to improve the landing field at Fort Smith, Northwest Territories, used in winter when commercial planes are equipped with skiis and will build a floating dock for use in summer when the planes are equipped with floats.

At Simpson, on the Mackenzie River, a portable house will be provided for passengers and mail. A floating dock with duck-boards to the river bank will be built. Similar improvements will be made at Norman, Aklavik, Cameron Bay, Resolution near Great Slave Lake and Rae.

Great Britain

H-SHAPED, AIR-COOLED 24-cylinder engines are now in production for the Royal Air Force at the Napier works, and the first batch will be installed in Hawker *Audax* army co-operation biplanes. Designed by Major F. B. Halford, the Dagger is notable for high output from small cylindrical capacity, fuel economy and compactness. Moderately supercharged, its output is 805 h.p.

FIRST FLIGHTS have been made at Hatfield Aerodrome of the new modified Comet ordered by T. Campbell Black, copilot with C. W. A. Scott of the machine that won the England-Australia air races, for a series of fast flights over some of the world's chief present and future air routes. Among the flights which he is planning are a flight across the North Atlantic Ocean to Canada and back, an attempt on the England-Cape Town-England record and a flight from England to Hong Kong. Black is also considering a record-breaking attempt on the England-South America run.

His machine embodies several improvements and refinements based on experience gained in building the three Comets that were entered in the England-Australia races. It is designed to cruise at at least 220 m.p.h. at 10,000 ft., and its range will be from 2,750 to 3,000 miles.

FROM THE Gloster company comes the F7/30 fighter biplane, the latest pursuit to reach squadrons of the Home Defence Force. It attains a maximum speed of 231 m.p.h. with full load at 16,000 ft. Though it carries heavier armament than its precedor, the *Gauntlet,* the F7/30 is faster and climbs almost as rapidly. Better performance has been secured by aerodynamical improvements, including the use of a cantilever undercarriage.

A DRAGON-RAPIDE twin-engined biplane, capable of a maximum speed of more than 160 m.p.h., and of cruising at 140 m.p.h., has been delivered to the Prince of Wales. The plane is similar in structural details to the standard Rapide. Its usual seating accommodation for eight passengers is displaced by six armchairs and special furnishings, including a writing table. Navagational equipment includes radio transmitting and receiving apparatus, and a complete set of blind flying instruments. Power is derived from two Gipsy-Six engines mounted in nacelles and tanks carry sufficient fuel for non-stop journeys anywhere within the British Isles.

Mexico

ASSERTING THAT it is impossible for them to comply with the law which demands that only Mexican pilots and personnel serve on transport planes, five companies, Compania Aeronautica del Sur, S.A.; Aeronaves de Mexico, S.A.; Sarabia Hermanos y Compania; Servicio Aereo Baughan, and Ruta Mexico a Manzanillo, and several pilots employed by them, petitioned President Lazara Cardenas to modify the measure. If the law as it now stands is enforced, these companies will be obliged to suspend operations as it is impossible for them to obtain a sufficient number of Mexican pilots and other members of crews, the petition asserted. The three-year term in which the Ministry of Communications and Public Works gave air transport companies to comply with this law has expired, but there is still a scarcity of Mexican pilots and trained aircraft mechanics.

Russia

ALTHOUGH OIL trouble forced postponement of the completion of the 6084-mile flight from Moscow to San Francisco by three Russian pilots, it is expected the flight will in the near future again be undertaken. The route to be flown is by way of the North Pole and according to plans will be a non-stop venture. At the controls of the Soviet-built U.R.S.S. 25 was Sigmund Levanevsky who was accompanied by Co-pilot George Baidukov and Navigator Victor Lychenko.

Soviet-constructed U.R.S.S. 25 in which an attempt will be made to fly non-stop from Russia to the United States

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An impressive feature is found in three pages illustrating tubing shapes in which 50 varieties are shown. A section devoted to aircraft tubing is most complete and instructive.

The wealth of material in this publication emphasizes the extreme versatility and adaptability of seamless tubing and should promote the extension of its field of applications. The publication itself, is well laid out and thoughtfully edited.

Tools

• CELEBRATION OF its 25th anniversary is featured by the publication of Black & Decker's Silver Anniversary DeLuxe Catalogue.

In keeping with the spirit of the occasion, the booklet is printed in aluminum. More than sixty-nine different basic portable electric tools are listed, illustrated, and described giving features, applications, specifications, accessories and price of each.

For people who appreciate fine tools, this publication should be a source of enjoyment. Publication office is Towson, Maryland.

Paint

• THE *Guide to Profit Through Paint* attempts to put paint on a unit cost basis and to show industrialists that properly approached the problem of painting a plant offers advantages in cost just as new machinery offers advantages over obsolete equipment. The subject of painting needs thorough research, and even more than thorough research it needs wide dissemination so that industry can take what amounts to maintenance material and make a real production asset of it. This booklet attempts to help create that understanding. The Sherwin-Williams Co., are the publishers.

Tool List

• AN ENGINEERING manual containing valuable information of interest to designers, engineers, and manufacturers of aircraft equipment, has just been published by the Wrought Washer Mfg. Co., Milwaukee, Wisc.

This handbook, *Special Washers and Stamping,* lists over 19,000 tool-sets for producing washers and stampings having application in the design and manufacture of practically every aviation product made. This publication, it is claimed, provides a source reference for the selection of assembly parts and special units which can be specified in the design and construction of new products.

Transmitter

• A PAMPHLET entitled 400 *Watt Radio Transmitting Equipment* issued by the Western Electric Co., describes a high-frequency transmitter for aviation ground stations and ship-to-shore service. The equipment transmits over any one of the ten pre-selected frequencies in the range of 2 to 18.1 megacycles, the shift being made automatically and quickly by the single twirl of a dial.

Pneumatic Tools

• INDEPENDENT PNEUMATIC Tool Co., Chicago, Ill., just issued Pneumatic Tool Catalog No. 50, illustrating in its entirety, the pneumatic tools manufactured under the Thor trademark.

In this catalog is a complete showing of these tools with specifications, etc., together with illustrations covering each type.

Rotary tools included are drills, wood boring machines, close corner drills, screw drivers, right angle nut setters, tapping machines, wrenches, air grinders, brushes, cone grinders and cone sanders and rod grinders.

Piston tools shown include air drills, wood boring machines, close corner drills, wrenches and heavy tube rollers.

Aluminum Paint

• THE USES and application of aluminum paint are set forth in an attractive 64-page booklet issued by the Aluminum Company of America of Pittsburgh, Pa.

Following information on how to secure best results, the booklet portrays, in words and pictures, the wide-spread industrial application of aluminum paint, and devotes one section to aviation.

The material can be applied to aircraft, on hangars and in factories. When used on aircraft wings or fuselages, it preserves the material because its bright surface turns back the sun's rays. When used in factories it improves working conditions by aiding illumination, and increases the life of structural metal by protecting it against rust.

BOOK REVIEWS

ELECTRICAL TROUBLE SHOOTING

By A. H. Packer

• THE THIRD edition of this practical book for the shop mechanic or electrician covers in addition to a wide range of other topics, the more recent problems of auto and aircraft trouble shooting which have come up in recent years. It includes vital information, written in easily-understandable style, on modern engine tune-up and radio service work as well as the underlying principles on which the starter, generator, magneto and other electrical units of motor cars and airplanes are constructed, and provides an accurate account of the means of attacking troubles for quick discovery of the source.

Of the 58 chapters, six are devoted exclusively to aircraft engines; other aircraft information is available from time to time throughout the text. While some of the information given concerns the outmoded Liberty engine, the other material applies to the general type of aircraft engine in present-day service. Chapters are devoted to aircraft engine magnetos; ignition- and lighting-circuit shielding for better radio reception; generators; and starting systems. Each chapter is concluded with a number of questions, the answers for which are found at the end of the book.

A. H. Packer, 8115 Harper Ave., Chicago, Ill., is the publisher.

RANKIN TEXT

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• A SYSTEMATIZED method of flight instruction has been made possible by a series of eight books written by Tex Rankin who has compiled a record of his methods of imparting flight knowledge to more than 1500 students.

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Book I is the *Theory of Flight* which contains, among other things, more than 100 examination questions; Book II is on *Structures and Rigging;* Book III, *Air Traffic Rules, Controls, Taxiing;* Book IV *Primary Flight Instruction;* Book V *Advanced Dual and Supervised Solo;* Book VI *Aircraft Engines;* Book VII *Meteorology and Navigation;* and Book VIII, *Advanced Flying and Flight Test.*

These books are more than a series of texts—they are a detailed report of results obtained, and conclusions arrived at, after years of systematic research in the field of aeronautical education. They are useful either as an instructors' manual; a standard text for students; or as an aviation home study course.

Rankin Text, Inc., of 311 Lumberman's Bldg., Portland, Ore., are the publishers.

OUR WINGS GROW FASTER

By Grover Loening

• PERSONAL EPISODES of the author's aviation life are a fairly accurate history of the development of the airplane in this country. From his first description of an exhibition plane's antics at Morris Park in 1908, till his closing paragraphs on the future of aviation there are the interesting events of Grover Loening's association with the airplane and aviation generally.

Well written and pictorially resplendent, this book is an accurate account of the development of the airplane told by one who has devoted practically his entire life to engineering, developing, and producing it. Tied in with Loening's activities, are personal accounts of the Wrights and others who were instrumental in giving aviation its start and helping it over the rough spots in its journey toward acceptance as a vehicle of transportation. The illustrations are worthy of mention, many never having been published previously.

Containing more than 200 pages, *Our Wings Grow Faster* is published by Doubleday, Doran & Co., of Garden City, New York.

BONERS OF A BUREAU BUNGLEER

(*Continued from page* 17)

sportsman pilot may flit about in his sport plane, but largely because it is considered wise to build up an aviation industry that would be competent to build planes for national defense in time of war. Vidal and his cohorts don't see it that way. They actually are against the industry, because the industry has been justly sceptical of their experimental publicity. Under the Air Commerce Act of 1926 the Bureau was organized to foster the development of aviation, not to attack that development by such statements as "all of our present type airplanes are unsafe for the private owner." Of course they are not as safe as riding in a Pullman car or sitting in a nice cool cell at Alcatraz next to Al Capone; but the dissemination of such vicious attacks by a paid public servant whose Bureau was formed to help aviation is something that calls for a protest. When Vidal and his hopefuls have produced the ideal safe airplane it is time enough *then* for them to urge that all private airplanes be built to the Vidal ideas. For them to seek funds for development by attacking everything existing now is merely impudent bureaucracy on their part.

Is Vidal sincere, or is he a publicity hunter, as so many people believe? Unfortunately, I believe he is sincere—the publicity is incidental. There is in him the fanaticism of the crusader; he is convinced that he is right, on the whole, and he will listen to no one. He was, I hear, once an athletic instructor, used to giving commands. Such a training sometimes gives a man the mental habits of a petty dictator, which is precisely what Vidal is. In the lengthy luncheon discussion I have referred to, not one idea in opposition to his policies was voiced by anyone but myself—and I talked only enough to draw them all out so I might understand them better. Neely, naturally, voices Vidal's thoughts; he is an excellent press agent. Bartlett, the Administrative Chief, is a nice chap; if he disagreed with Vidal he probably would find himself looking for a job—not in the aviation industry, of course. Martin, a shrewd man of the promoter type, undoubtedly is smart enough to recognize Vidal's program for the obvious experiment it is.

Yes, it was a pleasant little luncheon, and I was one thorn among a bunch of posies. I'm afraid I was too rough for them, and too sceptical.

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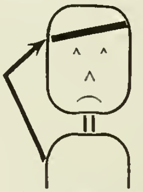

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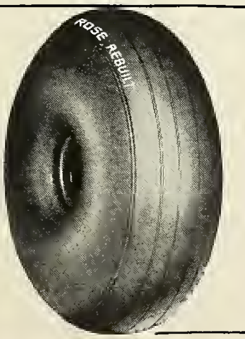

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MONOCOUPE M-5: Long wing, split landing gear. Licensed to June 15, 1936. Always hangared. Price $585. Kerr & McTavish, 3032 East Ave., N.E., Cedar Rapids, Iowa.

WACO 10: Licensed April 1936, $350. Warner Stinson, brakes, steel prop, top overhauled, will trade for J-5 job or $690. Ludvig Tweten, Box 1293, Minot, North Dakota.

BEST BUYS ON PAGE: Less motors; Kinner-powered two-place side-by-side Red Arrow Simplex monoplane, less Kinner motor, $275; B-1 five-place Ryan cabin ship, Goodyear full Airwheels and brakes, air tail wheel, dual controls, $675 for quick sale, less J-5 motor. Michigan Aero Motors, Jackson, Michigan.

AERONCA C-2: Entirely recovered and rebuilt; with or without motor. Boulevard Airport, Philadelphia, Pennsylvania.

BIRD OX-5: Excellent condition; licensed; air wheels; new paint, red and silver. Rock bottom price, $550. Patchogue Airways, Patchogue, L. I., New York.

J6-5 175 H.P. ROBIN: Electric starter, new battery; just relicensed. Very clean, never cracked; always hangared. Privately owned. A real buy for cash. Wesley Airport, Wesley, Iowa.

SELL EITHER ONE: Curtiss Robin, Challenger 185: 220 hours, full air wheels, brakes, de luxe four-passenger cabin, steel prop, etc., or Stinson SM8A: Few hours since major, wonderful condition. Will send photos. Will trade on faster ships, closed. R. E. Searle, Ogallala, Nebraska.

TRAVEL AIR: New motor; majored only eighteen hours ago; total time of ship, 593 hours. Rate of climb, turn and bank, thermocouple, oleo landing gear, extra large air wheels; cost $3,950 when new. Completely shielded for radio. Modernized at Wright factory for 250 h.p. Sportsman's plane of highest type. $1,500. Inquire S. Barisb, Room 307, 175 Main Street, White Plains, New York.

VELIE M-5 MOTOR: 25 hours, like new, $150. Hartzell Velie prop. $15. American Eagle Model 201, Kinner-powered, full air wheels. Just relicensed; two hours since top overhaul. Bargain, $650. G. W. Wiegman, Washington, Iowa, Route 1.

STINSON "R": Lycoming; de luxe finish and upholstery. Bargain, write for details. Set Ryan retractable landing lights; Travel Air 2000 tail surfaces, $3 each. Late model Taylor Cub, $1,100. Will trade Stinson on air-cooled ships. Valley Airways, Inc., Winchester, Virginia.

B-5 RYAN: The finest performing, most economical 6-place airplane available. This ship is in perfect condition, has all necessary instruments and equipment (including landing lights). Ready for any length air voyage. Must be seen to appreciate the reasonable sales price, which we will quote truly interested buyers. Will deliver anywhere in U. S. For complete details write Frog's Flying Field, Inc., East Moriches, L. I., New York.

STINSON "S": De luxe model, retractable landing lights, pants, turn indicator, climb indicator, air speed. 650 hours total. Just spent $450 having motor majored. $2,000 cash. Warren White, Albany Airport, Albany, New York.

WACO 10: OX motor major overhauled, Miller overheads; duals, standard instruments; licensed. $475. Cash or trade on Great Lakes, Fleet, Bird, etc. Harold Rohinett, 3325 W. 3rd St., Dayton, Ohio.

VELIE MONOCOUPE: Licensed, excellent condition. Wing recovered, complete ship refinished. $425 cash or trade for Eaglet or Taylor Cub. Wiley Rightnour, R. D. 2, Gettysburg, Penna.

CURTISS JUNIOR: Szekely; $325. Licensed to August 1936. Total time, 370 hours; since major overhaul, 70 hours. Will consider car in part payment. A. Farkas, 187 East 95th Street, New York, N. Y.

INLAND SPORT monoplane: LeBlond 70. Excellent condition throughout. Ideal trainer and exceptionally clean. $650. Want three-place open ship under $1,500. Pay cash or trade. R. P. Tucker, 2627 Glencoe, Denver, Colorado.

MONOPREP VELIE: Motor in perfect condition. Now flying. $500. Jack Remsen, 78 Parkhurst Street, Newark, New Jersey.

FOR SALE by original owner: Waco Cabin, WCK model; Jacobs engine, total time 210 hours. Complete instruments, including radio, flares, thermocouple, 70-gallon tanks, hand-rubbed finish. Wings, deep yellow; fuselage, black. Built-in pressure fire extinguisher installation; wheel pants. Ship perfect in appearance and condition. W. M. Packer, Packard Motor Car Company, Detroit, Michigan.

VELIE MONOCOUPE: Licensed to July 1935. New covers. Less than 100 hours. Bargain at $575 cash. R. Jackson, 702 Vanderbilt Avenue, Niagara Falls, New York.

J-5 WACO STRAIGHTWING: Ship and motor recently overhauled. Speed ring, bank and turn, head temperature, duals and other extras. $1,200 or best cash offer. Gordon Kilmer, 829 Leith, Flint, Michigan.

TRAVEL AIR E-4000 parts, priced to sell. Speed wings, tail sections, tanks and assorted accessories. Bendix wheels and brakes. H. Dawson, Municipal Airport, Buffalo, New York.

FLEDGLING: Challenger motor, excellent condition, reasonable. Also Irving seat pack chute, two three-minute flares, brackets and release; turn and bank; extra Challenger motor. R. H. Volgenau, 19 Orchard Place, Buffalo, New York.

AMERICAN EAGLE: Long nose, OX-5, licensed until April 1936. Miller overhead, new Fahlin prop. Less than 200 hours on motor and ship since new. One of last ships assembled by factory. $475. Bob Jackson, Municipal Airport, St. Joseph, Missouri.

125 WARNER FAIRCHILD 24: Cabin. Total time 175 hours, like new. Radio, navigation lights, landing lights, electric starter, wheel pants. Bloomsburg Flying Club, Bloomsburg, Penna.

SPARTAN: Walters engine; just majored; ship recovered and refinished; $850. Boulevard Airport, Inc., Philadelphia, Pennsylvania.

J6-5 TRAVEL AIR E-4000: Newly recovered; 50 hours since motor was modernized and major overhauled. Total time, 500 hours. A bargain at $1,200. Aymer Nelson, 2720 West Michigan Street, Duluth, Minnesota.

LICENSED CHALLENGER (185) Eaglerock: In good condition; black fuselage with silver arrow, silver wings. Direct hand cranking starter. Standard steel prop, perfect. Ten hours on engine since complete overhaul; about 450 in all. $845. Joe W. Hendrix, 108 B St., Hereford, Texas.

LYCOMING STINSON SM8A: Just relicensed, recovered and motor overhauled. Snappy red and yellow color. $1,650. Alton Walker, Western Airplane Distributors, 600 Graphic Arts Bldg., Kansas City, Missouri.

FLEET: Latest model 2, front exhaust, K-5, air wheels, late landing gear. Refinished, relicensed. Taylor Cub: Continental engine, winter enclosure, less year old. Never cracked. Indiana Air Service, Bendix Municipal Airport, South Bend, Indiana.

TRAVEL AIR B-4000: Semi-speed wing. Wright J6-9. Equipment: steel prop, lights, flares, starter, brakes; $1,375. H. Douglas, 936 Madison St., Oak Park, Illinois.

RYAN B-1: J-5. Five-place cabin. NC licensed. Perfect condition, motor just majored, air starter, new tires, recovered. Price, $1.100. Brown's Flying service, Alma, Michigan.

FOR SALE: OX Waco 10, recovered and majored; licensed and ready for service. A real bargain at $450. Box 91, Huntington, West Virginia.

1932 WACO CABIN: Leather upholstery, two speed rings. wheel pants ,ambulance equipment, Kinner C-5 210 h.p. motor, $2,600. Simplex Midwing, Kinner K-5, unlicensed, in good condition, $525. Cavalier coupe, $450. Used Warner parts. Late model cars taken in trade. Communicate Clayton Lemon, Municipal Airport, Roanoke, Virginia.

FOR SALE OR TRADE: 125 Warner Stinson, $900. Waco 90, late 1930, like new, $550. Want fast open ship. United Flyers, Box 176, La Crosse, Wisconsin.

REARWIN JR.: Like new; 146 hours total time. New pyralin winter enclosure, air wheels, air speed, late type crankcase 45 Szekely, extra incomplete motor; licensed August 15, 1936. $695. Light car taken in trade; will trade on three-place ship up to 175 h.p. H. C. Harris, Airport, Roanoke, Virginia.

STINSON SM8A: A-1 condition, new type landing gear, high-gloss finish. Waco F, very good. Fairchild 22, a bargain. Challenger Robin, just relicensed. Prices on request. Aviation Service Co., Inc., Hartford, Connecticut.

TRAVEL AIR 4000: With late Kinner K-5. Semi-air wheels, duals, complete engine and flying instruments. Licensed. Excellent condition. Lake County Airways, Willoughby, Ohio.

OXX-6 MILLERIZED latest type Travel Air 2000: Just relicensed, fine condition, many extras; 300 hours total time. If interested, see ship. L. W. Rodehorst, Columbus, Nebraska.

WACO NINE: Licensed until May, 1936. $444. Looks well, performs well. No repairs needed. Roland Ziegler, 934 E. Pacific Street, Appleton. Wisconsin.

FOR SALE OR TRADE: Licensed American Eaglet: 350 hours, newly recovered, new airwheels and prop. Position lights, many extras. Never cracked. Majored 30 hours back. Will trade in on Davis D-1 or Monocoupe. John Fernsler, Jr., 145 Crestmont Terrace, Collingswood, New Jersey.

SALMSON-POWERED Aeromarine Klemm: good condition, always hangared; oleo landing gear; clock; dual controls, booster. $450. Mermell, Floyd Bennett Airport, Hangar 3, Brooklyn, New York, Saturdays and Sundays.

TRAVEL AIR J-4: 3 POLB; nearly complete extra motor, blind flying equipment, radio, hood, tail wheel, front cockpit cover, ring, steel prop, 15 hours since major. Good for high altitude. Excellent condition, never cracked; licensed to March 1, 1936. $1,250. cash. Consider trade Warner or Kinner job. Melvin Sellmeyer, 6158 Holmes St., Kansas City, Missouri.

DEADLINE FOR CLASSIFIED ADVERTISING, OCTOBER ISSUE—SEPTEMBER 18th

Copy arriving after that date will be held over for the November issue

WACO F: Kinner B-5. Air starter, pants and ring. Motor and ship in A-1 condition. Licensed June 1936. G. W. Murrell, Marshall, Missouri.

TRAVEL AIR SPORT: Delivered 1934. Latest Wright J6-5. Total hours, 210. Licensed until July 1936. Eclipse starter, bank and turn, rate of climb. Never cracked, privately flown. Buying other ship. Ford Collins, 625 Skinker, St. Louis, Missouri.

CURTISS JUNIOR: 10 hours since major overhaul; new prop; wings recovered recently. Licensed to July 1936. $395. Motorcycle accepted in trade. Edwards Hangar, Flushing Airport, Flushing, N. Y.

MONOCOUPE: de luxe 90-A. 270 hours; 80 since top; always hangared, cared for by mechanic. Perfect condition; special tunnel cowl, pants, etc. Stearman vermilion. $2,650. Bustamente & Bauer, P. O. Box 2772, Miami, Florida.

FOR SALE: Eaglerock, Kinner K-5 motor; 20 hours since major overhaul. A-1 condition. Licensed until June 1, 1936. $700. Edith B. Hight, New Deal, Montana.

FOR SALE OR TRADE for Waco F: Eastman Flying Boat, 4-place, 185 Challenger. Complete rebuilt inside and out, 3 months ago. Total time since new, 145 hours. Licensed until June 15, 1936. Gil Angell, Lake George Flying Service, Lake George, New York.

FAIRCHILD "22": Ship 200, motor and prop 50 hours. Brand new Western Electric beam radio and Ohmer flying time recorder. Instruments both cockpits; starter, primer and wobble pump; special sport landing gear; pants, unbreakable glass windshield, clock, navigation and dash lights, fin brace wired, blind flying hood, etc. Also two silk chutes, Irvin, Switlik. Frank Rogers, Floyd Bennett Field, Hangar 3, Brooklyn, N. Y. or MIdwood 8-3189.

STINSON MODEL S: Good condition, licensed to July 1936; motor modernized; leather upholstery; black and silver paint. Ship has been well maintained. Standard instruments only. Time 1100 hours. Motor perfect, but time for major. $1,350. Evans Operations, Inc., 232 Peachtree, Atlanta, Georgia.

ENGINES: Majored by approved agency. Hornet B, $1,500; Hornet A-1, $850; Wasp S1D1, $2,500; Wasp C, $1,100; Wasp B, $750; J6-9-D, $1,100; J6-7-D, $775; J-5, $500; Kinner K-5, $300; Lycoming, 215 h.p., $575. Babb, 1100 Airway, Glendale, California.

BRAND NEW J-5 MOTORS: Last two in the world: Complete and crated. Cost $5,000. Sell 80% off. Western Airplane Distributors, 600 Graphic Arts Bldg., Kansas City, Missouri.

CURTISS ROBIN: Licensed, Challenger job. 20 hours since last overhaul. Ship completely recovered, attractive paint job, gray, orange, and white. Brakes, inertia starter; new glass over all, no pyralin. Cash, $750 or $200 cash and $50 per month for twelve months; no interest. No dickers; no trades. May be seen at Curtiss-Wright Airport, Glenview, Ill. Call or write Noble Cain, National Broadcasting Company, Chicago, Illinois.

FOKKER "AIR EXPRESS": Hornet motor with thirty hours since major. Not flown for 18 months. Now unlicensed. First thousand dollars takes it. Or sell Hornet, $600; with three-bladed propeller, $700. Florida Skyways, Miami, Florida.

OX ROBIN: Millerized motor, 150 hours total time. Ship in good condition throughout. Licensed to December 1935. A good buy at $500. H. Lindsay, 120 Park Ave., Portland, Maine.

ONE FIVE-PLACE J6-7 Standard for sale, in excellent condition. Licensed to September 1936; no reasonable offer refused. J. M. Sterling, 665 Central Avenue, Albany, New York.

THESE SHIPS MUST SELL: Aeronca C-3, total time 160 hours; winter enclosure, oleo landing gear; motor and covering perfect; licensed to July 1936; never cracked, always hangared; priced to sell. Waco GXE, OXX-6, covering one year old; motor just majored; licensed to August 1936. Color red and silver. A real ship for barnstorming. Will sacrifice. W. W. Clark, Bune Vista Pike, Portsmouth, Ohio.

DAVIS: LeBlond 65; excellent condition, 289 total hours; flown 63 hours since major overhaul. Licensed until June 1936; $750. Willis Kysor, Niles, Michigan.

FORD TRIMOTOR: with J-5's, for sale. Motors majored by Wright service station. Licensed for fourteen. Ship excellent condition, with direct electric starters, generator, speed rings, new metal interior, new metal chains. Ship now working with good income. Possession given without stopping income if desired. Also J-5 Travel Air for sale. Wire or write Dale P. Smith, Springfield, Missouri.

'35 MODEL FAIRCHILD 24: 65 hours; perfect; $4,675 cash, no less. Max Marshall, 402 N. King Street, Xenia, Ohio.

FOR SALE: Douglas M-4 biplane; Liberty motor. Like new; equipped for high sky-writing; uses phosphorous chemical. Rieke Metal Products Corp., Auburn, Indiana.

FOR SALE: Fairchild FC-2; overturned in windstorm. Fuselage buckled; engine damaged. Wings, landing gear O.K. Write for details. Aerial Surveys of Pittsburgh, Inc., Loeffler Building, Pittsburgh, Pennsylvania.

VELIE M-5 MONOPREP: Enclosed. Recently recovered. Motor and ship in excellent condition. $475. Elmer Berg, Box 22, Devils Lake, North Dakota.

BIRD: Kinner 100; late type motor, new Hamilton steel propeller; air wheels, covering one year old; licensed until August 1936. Priced right. Donald Dotterer, Emlenton, Penna.

1932 WACO CABIN: 210 Continental; 190 hours on engine; radio; turn-bank, rate of climb; hand rubbed finish. $2,299.99. Want Warner Waco F, any condition. Lou Wehler, Littlestown, Pa.

WARNER WACO F: 275 hours; ship and motor perfect; original color. Extra motor, ring, pants, night flying equipment; air speed, compass, etc. $1,550 complete. Russell Neff, Holman Airport, St. Paul, Minnesota.

RYAN 5-PLACE: Overhauled, recovered, good as new. To highest bidder—must sell. Werts Novelty Co., Inc., Muncie, Indiana.

FOR IMMEDIATE SALE or exchange: 11 certified airplanes to choose from, as follows: J6-7 250 h.p. straight wing Waco; one J-5 straight wing Waco; C-1 J6-7 4-place cabin ship; J-6 B-5 6-place Ryan cabin ship, airwheels; J-6 6-place Stinson cabin ship, airwheels; Rover 75 h.p. 2-place Driggs training ship, late model; two Type 2000 OX-5 Travel Airs; one OX-5 Curtiss Robin; one OX-5 Waco 90; Continental A-40 powered Heath. All ships NC licensed, ready for delivery. Good late model cars taken on deals. Terms to responsible buyers. Becker-Forner Flying Service, Inc., Jackson, Michigan.

FOR SALE: Aeronca C-3, winter enclosure, oleo struts, over-size airwheels; 75 hours since major overhaul on motor. Ship excellent. Always hangared; licensed. A bargain for cash. AERO DIGEST, Box 2127.

BULL PUP: Excellent condition; motor majored 10 hours ago; total time, 200 hours. $450. George Laritz, c/o Boulevard Airport, Roosevelt Blvd. & Red Lion Rd., Philadelphia, Penna.

NEW STANDARD J-5: 5-place job. Can be bought cheap. Motor and ship in perfect condition. Steel prop, starter, landing lights, tail wheel, brakes, etc. This ship is a steal. Act now. Harry Cobb, 1319 N. Brandon Ave., Norfolk, Virginia.

LAMBERT MONOCOUPE: 60 hours total; semi-air wheels and brakes; single strut landing gear; steel propeller; $1,500. Will take light car in trade, or Stinson S. Leon R. Alsworth, Sherburn, Minn.

FOR SALE: OX American Eagle. Excellent condition. $350. Can be seen at Elmhurst Airport, Elmhurst, Ill., or write Ed Nelson, 2221 W. Madison St., Chicago, Illinois.

FOR SALE OR TRADE: Cirrus Avian, excellent condition; air wheels, OX Waco, recovered and rebuilt, perfect condition. 185 h.p. Challenger, complete with steel prop, just overhauled. Will buy ship less Challenger motor. Four-place cabin monoplane, less motor, trade for automobile. Harry Deuter Garage, 318 W. Washington, Fort Wayne, Indiana.

BARGAINS: Curtiss Pusher, completely refinished and relicensed. Lowest price $325. Wallance Tourloplane: Kinner, 3-place cabin, brakes, tail wheel, side-by-side duals, folding wings, $750. Indiana Air Service, Bendix Municipal Airport, South Bend, Indiana.

FOR SALE: Warner Aristocrat; OX-5 Waco 10; licensed and in excellent condition. Kinner K-5 side exhaust engine. Tuscarawas County Aviation, Inc., Schoenbrunn Airport, New Philadelphia, Ohio.

33 DE LUXE STINSON RELIANT: Original finish, cannot be told from new plane. 160 hours since complete factory overhaul on engine. Landing lights, flares, turn and bank and rate of climb, red leather upholstering, 72 gal. gas capacity, full streamlining, special paint and other extras. A real bargain at $3,750. Frank C. Reynolds, 601 Arlington Road, Roanoke, Virginia.

GEE BEE SPORTSTER: Warner motor; ship and motor perfect. Only pilots capable of flying this ship inquire. Boulevard Airport, Inc., Philadelphia, Pennsylvania.

FOR SALE: Kinner Bird. Excellent condition. Will trade. AERO DIGEST, Box 2131.

FAIRCHILD CABIN J-5; J-5 Eaglerock; J-5 Travel Air; Challenger Command-Aire; OX-5 Monarch; OX-5 Waco; C-W Junior. All ships licensed, good condition, reasonably priced. Air Activities Airport, West Chicago, Illinois.

SALE OR TRADE: Rearwin Junior, SR-30; licensed, good condition; 620 hours; top overhaul now; excellent trainer. Want three-place open, also three-place cabin; seat pack; must be reasonable. Need mechanic. Tri-City Airport, Wisconsin Rapids, Wisconsin.

WARNER FLEET: Recovered, engine late type, just overhauled. Instruments front and rear. Wright J6-7 open Travel Air. Perfect condition, just relicensed. Howard Schmidt, 20-16 Whitestone Avenue, Whitestone, L. I., New York.

FOR SALE: J-5 Waco straightwing seaplane. Late type Edo floats and water rudders. Ship and motor in excellent condition. Quick sale, $1,400. Hylan Flying Service, Airport, Rochester, N. Y.

J-5 SPEEDWING TRAVEL AIR: Completely rebuilt, in A-1 shape, $1,150. Reich Flying Service, Hangar 33, Roosevelt Field, Mineola, New York.

AEROMARINE KLEMM: Sacrifice reconditioned Salmson Klemm, licensed May 1936; air wheels, duals, red wings, black fuselage. S. P. Daily, Teterboro Airport, Hasbrouck Heights, New Jersey.

OX-5 ROBIN: $300; Bird, $425; Heath, $65. Three of hundreds of bargains listed in Used Aircraft Directory, sent for 20c postpaid. Used Aircraft Directory, Athens, Ga.

J-5 BELLANCA: Licensed June 1936. Hamilton Standard propeller, bank and turn and rate climb. Engine 500 hours, 200 since major. Spare engine, 700 hours. Spare Hamilton Standard propeller. Set Pioneer landing lights. Parts third engine, less front crankcase and minor parts. Ship located New York. Everything, $1,500. Airplane for $1,200. Bill Behrens, 113 Seaman Avenue, Baldwin, New York.

KINNER EAGLEROCK: Late type front exhaust. Steel prop; wings, tail surfaces recently refinished. Ship and motor excellent condition. Price, $725. E. H. Friddle, Stokesdale, North Carolina.

WACO J-5: Just refinished, vermillion fuselage, silver wings. Equipped brakes, starter, metal prop, position lights. Covering A-1. Asking $1,350. Reasonable offers and trades considered. Kenneth Joseph, West Chester, Ohio.

WACO F-2: New Jacobs motor, factory guaranteed; ship 215 hours; in excellent condition throughout. John Warner, 1535 Decatur St., Brooklyn, New York. HEgerman 3-4000.

TRAVEL AIR: OX-5. Motor perfect, wings recovered, ship refinished, licensed July 1936. $550. Will accept late car part payment. Russell Byer, Willshire, Ohio.

FOR SALE: 1932 model NB-8 monoplane with Genet 80. Plane and engine in excellent condition; time 150 hours; NC license to May 1936. Price $800. AERO DIGEST, Box 2130.

FOR SALE: Eaglet, Szekely motor SR-3L. Ship just relicensed. Motor majored, total time 250 hours. Price $475. H. Douglas, 936 Madison St., Oak Park, Illinois.

OFFERS FOR IMMEDIATE SALE at closing out Bargain Prices: J6-5 175 h.p. Wright motor, $325; J4 220 h.p. motor, $195; J6-7 250 h.p. Wright motor, $575; Velie 65 h.p. motor, $115; J6-9 330 h.p. motor, as is, $350; nearly new J6-9 330 h.p. Wright motor, just major overhauled, $850; brand new 22 x 10 x 4 Goodyear full Airwheels, including new hubs, $35 each. Steel propellers for above motors priced on request. All Warner and Wright motor parts, 60% to 80% off. B-1 five-place Ryan cabin ship, less J-5 motor, $675. Kinner-powered new two-place Red Arrow Simplex monoplane, less motor, $275. We are closing out. Write or wire your needs. Michigan Aero Motors, Jackson, Michigan.

WARNER MOTOR: 125 h.p. with brand new propeller. $295 for quick sale. 75 hours since overhaul. Western Airplane Distributors, 600 Graphic Arts Bldg., Kansas City, Missouri.

FAIRCHILD 22: Wright Gipsy; 160 hours total; privately owned; never cracked; always hangared; equipped for blind flying; navigation lights; duals, semi-airwheels, brakes, hand crank starter; special paint job; other extras. Excellent condition; just relicensed another year. A bargain at $1,800, no trades. Marion P. Hair, Winburn Field, San Antonio, Texas.

FAIRCHILD "24": Cabin plane. Has extra equipment worth $500. 200 hours flying time. This ship is in first class condition. Real bargain to quick buyer. F. D. Kessler, 138 Queen St., Northumberland, Pennsylvania.

PLANES and ENGINES FOR SALE

GREAT LAKES TRAINER: Licensed to August 1936. 600 hours, $800. Salmson Eaglet: Identified, $400. Two Irvin pongee seat pack chutes, $40 each. Hunter Goodwin, 1306 North 23rd Street, Richmond, Virginia.

PACKARD DIESEL Stinson SM-8D: Four-place, new airwheels, R C A radio, starter, generator, instruments. Total time, ship 385, motor 185. Only 40 hours since overhaul by Packard. Licensed, $1,200 (or without motor). E. Jones, Box 442, Kingston, Pennsylvania.

KELLETT AUTOGIRO: Powered with 210 h.p., total time 240 hours. Privately owned, never used commercially, cannot be told from new. Wings Corporation of Philadelphia, Ambler, Pennsylvania.

STINSON SR5A: With flaps, Smith propeller, radio, blind and night flying equipment. Delivered November 1934. Perfect condition. Motor just majored. John Shohe, Boston Airport, East Boston, Massachusetts.

PORTERFIELD FLYABOUT: 35 hours total time, LeBlond 70. Bought new June. Speed ring, compass, air speed; price, $1,600. Robert Kashower, Miramar Apartments, Washington, D. C.

GREAT LAKES 2T-1A: 1930. NC licensed. Perfect condition, never cracked. Full air wheels. Nickel plated struts and wires. Total time, 300 hours. Price, $850. Brown's Flying Service, Alma, Michigan.

FAIRCHILD 21: Cylinder faired Kinner; Heywood starter, brakes, duals, metal cockpit cover, instruments. Licensed to May 1936. Privately owned, $975. All offers considered. R. Gabler, Main Line Airport, Paoli, Pennsylvania.

STINSON SM8A: Lycoming; air wheels, rings. Refinished last fall, $1,500. OX Challenger: Fabric, prop new, $500. Ships always hangared. Pete Grim, 638 Virginia Avenue, South Roanoke, Va.

FOR SALE: Jacobs cabin Waco; Eaglet; Straight wing Waco; Kinner Travel Air Sport; Stinson S; Stinson Reliant; Great Lakes; Bellanca Skyrocket; Bellanca Pacemaker; Kinner Fleet; Fairchild 24; Fairchild 22; J6-7 Stearman; Wasp Laird; cracked-up Laird; Monocoupe and Fairchild parts; Wasp C motor. Aircraft Sales Co., Roosevelt Field, Mineola, New York.

FOR SALE: Hisso E Eaglerock. Extra motor. Ship and motors in good condition. Licensed till May 1, 1936. $750. J. P. Alexander, Albany, Texas.

KINNER K-5: Side exhaust motor, 500 hours total; serviceable, needs top overhaul. Complete with prop, $225. James Rose, Commonwealth Flying Service, Elmhurst, Illinois.

FOR SALE OR TRADE: Hisso Eaglerock, in excellent condition, $650 cash. Aerial camera, excellent, $150 cash. Complete description upon request or will trade both for Great Lakes or Lambert Monocoupe needing minor repairs or recovering; no crack-ups wanted. Charles J. Farmer, E. Church St., Eden, New York.

LAMBERT DELUXE MONOCOUPE: Brand new 1935 latest model; less than 10 hours time; beautiful French gray and Fokker red finish; equipped with flaps, bank and turn, rate of climb and all regular instruments; tail wheel, navigation lights, special motor cover, 116 lbs. baggage allowance; landing speed 40 miles per hour; climb, 900 ft. per minute. Must sell at once. H. F. Wood, Avenue C & 19th Street, Birmingham, Ala.

OX WACO GXE: New prop, splendid condition. Just refinished, licensed August 1936; compass. A steal at $425. John P. Sutherland, 556 Rose St., Lexington, Kentucky.

FOR SALE: J-5 FC-2 Fairchild, five-place cabin, licensed to June 1936; steel prop, excellent condition, must be sold. $850. Box 91, Chesapeake, Ohio.

WACO F: Kinner 125, just majored; perfect condition; licensed until August 1936. W. Kemp, Westchester Airport, Armonk, New York.

VELIE MOTOR: About 10 hours since new; new Gardner prop. Price $140. G. C. Ackerman, care Eastern Aeronautical Corp., Newark Airport, Newark, New Jersey.

KINNER BIRD 100 H.P.: Maintained and equipped as exacting private owner wanted. New Western Electric radio. Bonded. Full airwheels and brakes. Extra instruments. Plane and motor majored 46 hours ago. Viking Flying Boat Co., New Haven, Connecticut.

AERONCA C-3: Recent factory major on ship and motor (E-113-A). Beautiful special high gloss yellow and red finish. New prop, windshields, etc. Perfect condition; can be financed. $1,075. Al Leeward, Vandergrift Airport, New Kensington, Penna.

ATTENTION, CALIFORNIA Pilots: Fine Stinson R, excellent finish, condition; $300 extras, red leather; trade for bungalow, business property on coast. Sell outright. Dr. Haynie, San Bernardino, California.

WACO 10: Top Millerized, now 396 hours on ship, 474 on motor; licensed to March 15, 1936. Good condition. $400. Consider trade on Waco F. Peter E. Johnston, Milan, Michigan.

FOR SALE: Nicholas-Beazley NB-8 Trainer. Covering excellent; airwheels, engine ring; 500 hours total; license to October 1936 guaranteed; $475. Also, J-5 Travel Air Speedwing: Licensed to August 1936. 330 total honest hours since new, ship and engine; steel prop, Bendix wheels, duals; excellent; or trade Waco F, Great Lakes, Driggs or similar. Sig Wilson, Marquette, Michigan.

GEE BEE TWO-PLACE Sportster: Side-by-side; Kinner 90 motor; total time 300 hours; motor just majored; cylinder heads reinforced; has tail wheel and brakes. Just relicensed. Price $975. Will accept trade. Andrew Stinis, Floyd Bennett Field, Brooklyn, New York.

FOR SALE: Challenger Robin. Ship time, 375 hours; engine time, 400 hours. 50 hours since top overhaul. Engine in excellent condition. Ship has extra heavy wheels, new tires, tail wheel, bank and turn. Color, white and red. Covering good except tail surfaces, fair. Licensed until February 15, 1936. Also new right Robin wing with gas tank, in original crate. Serv-Air, Inc., Raleigh, N. C.

BOEING—DH4 M-1 Liberty engine; Hamilton steel propeller. Ship and engine in A-1 condition. Can be used for banner towing, advanced student work or crop dusting. $250. Fred Vilsmeier, 857 E. Luzerne St., Philadelphia, Pennsylvania.

LAMBERT DELUXE MONOCOUPE: 105 hours, less than year old; turn and bank, starter, battery, red leather upholstery, wheel pants, tail wheel, magnetos radio shielded; grey trimmed in red. Never damaged. Always privately owned. $2,725. Waco F Kinner B-5: 45 hours; black with red wings; Heywood starter, baggage compartment, navigation lights. $1,575. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Ind.

AERONCA CABIN Demonstrator: 3 months old, like new, $1,450. Fleet model 2, with Kinner K-5 front exhaust, $990. Russell parachute, excellent condition, $30. Queen City Flying Service, Inc., Lunken Airport, Cincinnati, Ohio.

FOR SALE: J6-5 Travel Air; licensed until next May. Aeromarine closed "Cub"; licensed. Taylor Aircraft Company, Bradford, Pennsylvania.

BARGAIN: OX-5 3-place Command-Aire, licensed August 1936. A-1 condition; duals, overhead motor. New spare OX-5 with ship, or sell separate. Henry Hearts, 1138 Sledge, Memphis, Tennessee.

STINSON R: Perfect; flares, landing lights, ring cowling, wheel pants; never cracked. Priced low for quick cash sale. George Casey, 4227 Snelling Avenue, Minneapolis, Minnesota.

FOR SALE: J6-9 six-place Stinson; approximately 40 hours since major overhaul on motor and entire recovering of the ship. Will be sold for the highest bid over $1,000 by October first. Chicago Suburban Aviation Corp., Stinson Airport, La Grange, Illinois.

SACRIFICE TANK ROBIN: Perfect condition throughout. Ship total hours, 200. Motor since new, 100; just top overhauled. New Fahlin propeller. Very economical and good performance. Must be seen to appreciate value. $975 cash. Mankato Aero Service, Mankato, Minnesota.

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J-5 COMPLETE: 179 hours, $250. Gipsy, less right hand mag., 40 hours, $125. English Cirrus, complete, recently majored, $100. Kinner K-5, needs pistons, mags, drives for mags, $100. Two Curtiss C-6, excellent condition, complete, $75 each. Bendix electric starter, $15. Bendix inertia starter, $10. H. W. Rearick, 1474 Harvard St., N.W., Washington, D. C.

HAVE WARNER STINSON and a completely overhauled spare Warner. Will consider trade on a small 2-place ship or will sell separately. AERO DIGEST, Box 2134.

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FAIRCHILD KR-34: J6-5, modernized engine, recently overhauled. Very good condition and appearance. Best offer takes airplane. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Penna.

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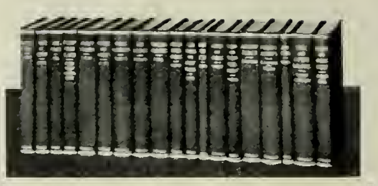

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How to make the calculations in the stress analysis required by the Department of Commerce. Each point is explained with the utmost clearness; advanced mathematics has been avoided as far as possible. Explains principles of applied mechanics involved. Takes as an illustration an average airplane and gives full examples of all computations required. Includes tables giving vast amount of stress data, covering steel, wood, tubing, hard wire, steel cable, tie-rods, rivets, bolts, etc.

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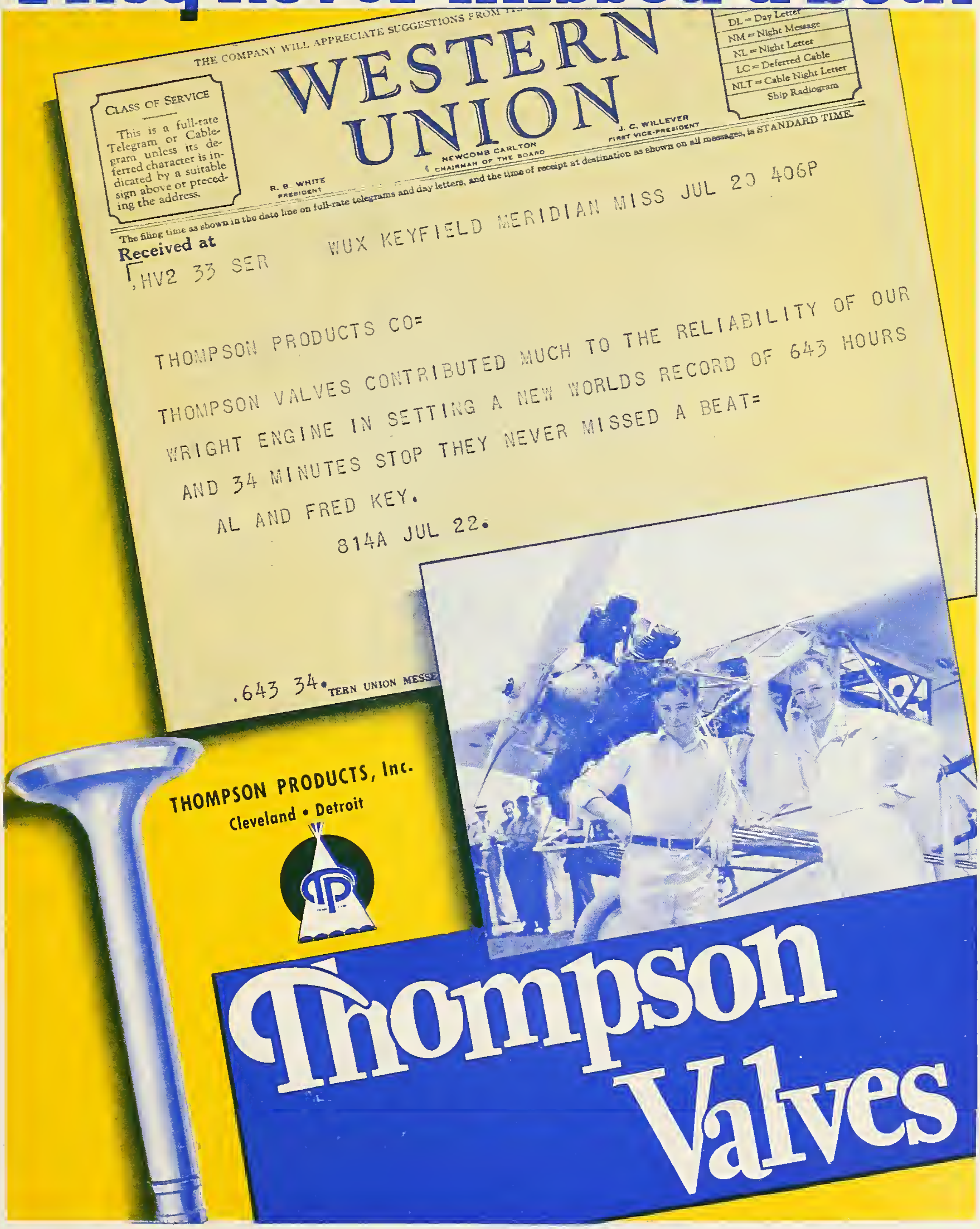

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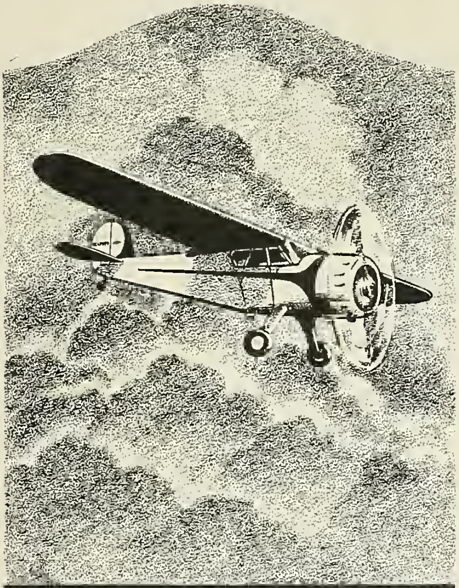
AERO DIGEST, *October, 1935*
Volume 27, Number 4

Published monthly by Aeronautical Digest Publishing Corp., at 515 Madison Ave., New York, N. Y. Yearly subscription, $3. Entered as second class matter July 17, 1922, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Additional entry at the Post Office, Philadelphia, Pa.

WORLD'S MOST EFFICIENT AIRPLANE



PERFORMANCE (with Wood Propeller):

High speed, fully loaded, sea level	162 m.p.h.
Cruising speed, fully loaded, sea level	143 m.p.h.
Landing Speed, with wing flaps down	47 m.p.h.
Climb first minute	1,000 ft.
Cruising radius	550 miles
Gasoline consumption at cruising speed	9 gal. per hr.
Air mileage per gal. at cruising speed	16
Service ceiling	18,900 ft.

Competing with all kinds of commercial aircraft at the National Air Races, the Cessna C34 was officially designated the "World's Most Efficient Airplane."

Cessna has enjoyed the confidence of the industry since the beginning of commercial aviation. Cessna airplanes are in active daily service throughout all parts of the world. Model C34 is the latest Cessna to be introduced to the flying public. Traditional to Cessna design we sincerely feel that this new model is as far ahead of other modern airplanes as the previous Cessnas have been ahead of the airplanes of their day.

At the National Air Races we were not content to win the efficiency events for airplanes in our own class (550 cubic inch displacement). We entered our 145 horsepower, model C34, in the 800 cubic inch class as well, and against airplanes with greater horsepower, winning that event too. Cessna C34 was officially designated the "World's Most Efficient Airplane."

True, there are airplanes with larger motors that have greater speed than this New Cessna—but not one was able to defeat the C34 for all around performance, comfort, maneuverability, and economy of operation. In giving the performance of the C34 we are stating to you "Proven Performance."

CESSNA C34

POWERED BY WARNER

Type: Four-place cabin land monoplane.

Engine: Warner Super-Scarab, 145 h.p. at 2,050 r.p.m. Dependable, efficient and economical.

Tankage and Baggage: Thirty-five gallons of gasoline; three and one-half gallons of oil. Range at cruising speed, four hours. Ample compartment and allowance made for baggage.

Landing Gear: Full cantilever (heat treated), with oil spring shock absorbers and six-inch vertical travel. Tail wheel is full swivel with oil spring shock absorber.

Wing: Area, 180.5 sq. ft. Laminated spruce spars, continuous from tip to tip. Full cantilever, tapered construction. Plywood covered leading edge and tips. Span, 33 ft. 10 in.

PRICE

$4,985

With Standard Equipment,
F.A.F. Wichita, Kansas
Two-tone color scheme; customer's choice of colors

Weights: Weight empty, 1,300 lbs. Gross weight, 2,220 lbs. Pay load, 680 lbs. to 822 lbs., including pilot.

Standard Equipment: General streamline tires . . . dual controls, including brakes . . . combination parking brake and rudder lock . . . wing flaps . . . longitudinal trimming tabs . . . N.A.C.A. engine cowling with pressure baffling . . . Kollsman instruments, oil pressure, oil temperature, tachometer, altimeter, air speed, compass, gasoline gauge . . . electric starter . . . battery . . . navigation lights.

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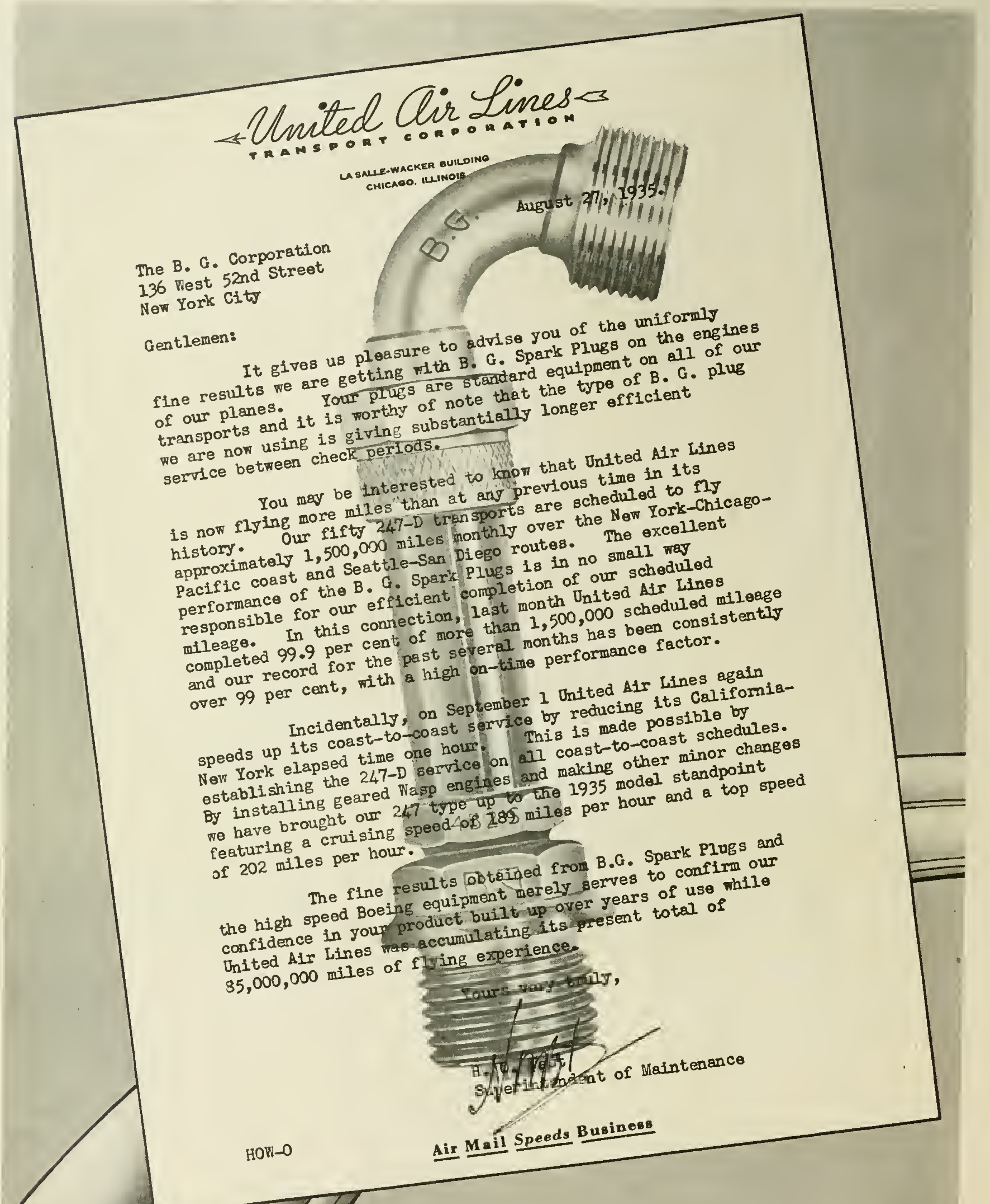

United Air Lines
TRANSPORT CORPORATION
LA SALLE-WACKER BUILDING
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August 27, 1935.

The B. G. Corporation
136 West 52nd Street
New York City

Gentlemen:

It gives us pleasure to advise you of the uniformly fine results we are getting with B. G. Spark Plugs on the engines of our planes. Your plugs are standard equipment on all of our transports and it is worthy of note that the type of B. G. plug we are now using is giving substantially longer efficient service between check periods.

You may be interested to know that United Air Lines is now flying more miles than at any previous time in its history. Our fifty 247-D transports are scheduled to fly approximately 1,500,000 miles monthly over the New York-Chicago-Pacific coast and Seattle-San Diego routes. The excellent performance of the B. G. Spark Plugs is in no small way responsible for our efficient completion of our scheduled mileage. In this connection, last month United Air Lines completed 99.9 per cent of more than 1,500,000 scheduled mileage and our record for the past several months has been consistently over 99 per cent, with a high on-time performance factor.

Incidentally, on September 1 United Air Lines again speeds up its coast-to-coast service by reducing its California-New York elapsed time one hour. This is made possible by establishing the 247-D service on all coast-to-coast schedules. By installing geared Wasp engines and making other minor changes we have brought our 247 type up to the 1935 model standpoint featuring a cruising speed of 185 miles per hour and a top speed of 202 miles per hour.

The fine results obtained from B.G. Spark Plugs and the high speed Boeing equipment merely serves to confirm our confidence in your product built up over years of use while United Air Lines was accumulating its present total of 85,000,000 miles of flying experience.

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Superintendent of Maintenance

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What it took to win America's greatest Air Races

Planes

At the National Air Races recently held in Cleveland were assembled the most powerful planes in America. Of these, *one* stood out...the high-wing monoplane "Mister Mulligan" which won both major events.

Pilots

In a field of America's greatest speed flyers, *two* men took top honors. Winner of the 2042 mile Bendix Derby was dark, lean Benny Howard. Victor of the perilous Thompson Trophy Race was daring Harold Neumann. Both flew the same plane—"Mister Mulligan."

Products

Many fuels and lubricants powered the roaring motors. Of these, *one* gasoline and *one* motor oil swept the field. Not only was "Mister Mulligan" powered with GULF AVIATION AIRLINE GASOLINE and GULFPRIDE OIL, *but out of 11 races Gulf took 8 first places, 3 seconds, 7 thirds.*

To win the two premier aviation competitions of the year—The Bendix Trophy Race and The Thompson Trophy Race—has been the dream of every oil company in America. Gulf did it...with Gulfpride SAE 60...and Gulf Aviation *Airline* Gasoline. A tribute to the quality of Gulf products!

GULF GASOLINES GULF AND MOTOR OILS

Do YOU want to be an AIRLINE PILOT?

A few of the many Parks trained pilots flying scheduled airlines.

Marvin Parks (below)—unrelated to Parks Air College officials—flies from Buenos Aires in coastal service for Pan American Airways.

Luam Phonese-Sobhon (above) flies in Siam from the coastal plains, which are drenched by torrential rains a large part of the year, to the highlands of the interior, which are famed for sapphires and rubies.

Al Laney is flying for Eastern Airlines on the new Douglas plying between Chicago and Miami

Charles J. Kratovil flies the coast-to-coast route for Transcontinental and Western Air.

You can be if you will take advantage of the professional flight training for commercial pilots offered in the Executive Transport Pilots Course by Parks Air College.

Parks trained pilots are now flying for such airlines as Transcontinental and Western Air, American Airlines, Eastern Airlines, Weddell-Williams Air Service, Star Flying Service of Alaska, Pan American Airways and for commercial airlines in foreign countries.

AIRLINE PILOTING IS A LEARNED PROFESSION . . .

Because of the great responsibility carried by the airline pilot and because of the extensive scientific knowledge and technical skill required of him, it is now necessary to recognize airline piloting as a learned profession.

The airline pilot is solely responsible for the safety of his passengers, mail, express and plane. The plane itself will have a value varying, according to its design and size, from forty thousand to three hundred thousand dollars.

The airline pilot must, in order to meet present day requirements for flying three mile a minute transports through all weather conditions and over all kinds of terrain, have a thorough theoretical and practical working knowledge of the sciences of meteorology and navigation. He must also be skilled in the operation of aircraft radio and in airplane and engine inspection and maintenance.

BUSINESS TRAINING

If he is to take full personal advantage of his opportunities as a pilot, he must be well acquainted with the business phase of airline operation, its principles and their application. It is to his advantage, in order to multiply the value to himself of his scientific knowledge and technical skill, to have an intimate knowledge of the principles of salesmanship and the use of business English, both written and spoken.

EXECUTIVE TRANSPORT PILOTS COURSE

All this training is provided in the two-year Executive Transport Pilots Course.

The flight training includes 230 hours of closely supervised instruction on various plane types. Radio beam and instrument flying and actual airline piloting experience on an airline operated by Parks Air College solely for training purposes is a part of the flight training.

This course was built with the advice and cooperation of numerous airline executives. It includes the training they want their future pilots to have. Acknowledgment must also be made for valuable assistance in building this great course which was given by the Bureau of Air Commerce officials in charge of airline inspection.

Training in Engineering and Maintenance

Major courses, each requiring two years for completion, are also offered at Parks Air College in Aeronautical Engineering and airplane and engine maintenance.

The training provided in the Aeronautical Engineering and Master Mechanics Flight Courses is just as complete in the respective fields as is the piloting and executive training in the Executive Transport Pilots Course.

FREE CATALOG and BULLETIN

If you want to become an airline pilot—or if you want to make a career for yourself in any other field in commercial aviation, it will pay you to secure complete information about the training offered you by Parks Air College. It is included in the Catalog and Bulletin. These books are free. *The filled in coupon will bring them to you.*

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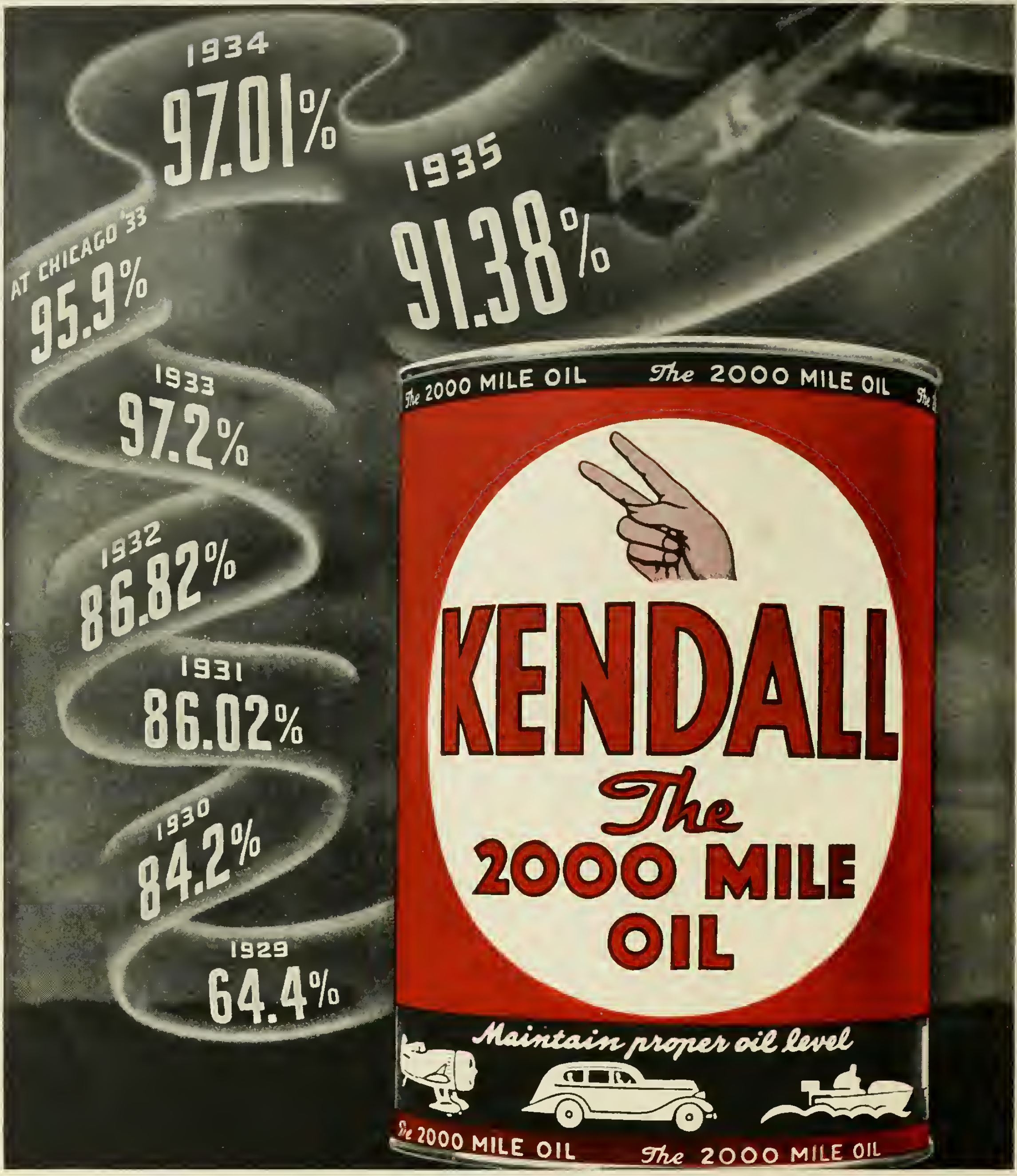
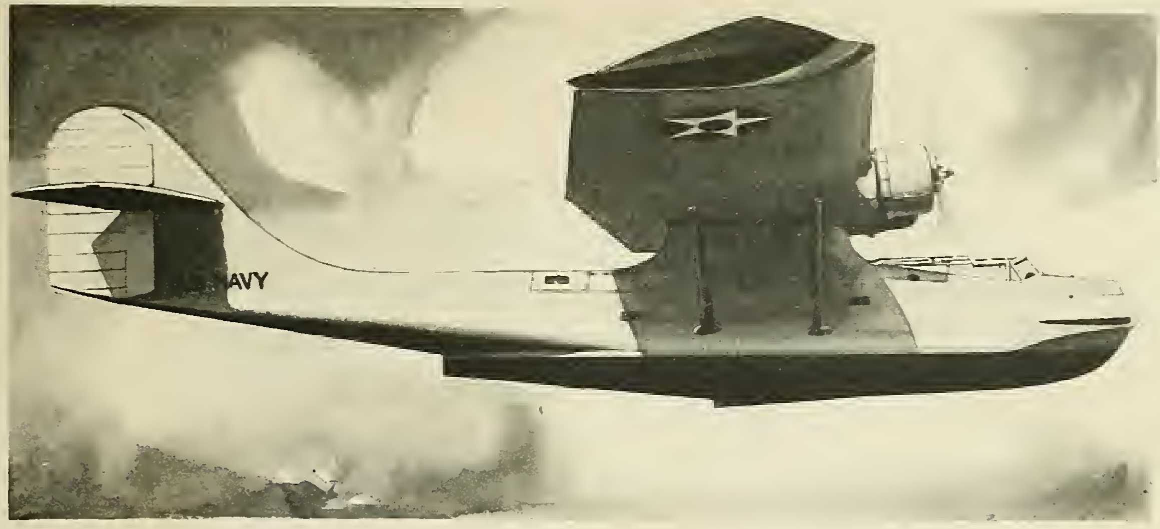


Year after Year— KENDALL BRINGS IN THE WINNERS!

NO OTHER OIL in the world has ever blazed a victory trail like this! Ever since the National Air Races became the outstanding aviation event of the year, Kendall Oil has lubricated the engines of more winning planes than all other oils combined! Year after year, race after race, Kendall Oil has helped to bring the winners in.

This year was no exception. Kendall again triumphed . . . 91.38% of all winning pilots used Kendall Oil when they roared to victory. Kendall gives this dependable lubrication because it is refined by special Kendall processes 100% from Bradford Pennsylvania crude.

KENDALL REFINING COMPANY : BRADFORD, PENNA.



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Home of the Best Aviation Training

Here—in a nutshell—are the courses being pursued by students at D. A. S.—students from more than half the states of the Union and from several foreign countries:

Master Airman and Transport Pilot's Course

291 air hours—600 hours classroom instruction—900 hours shops—100 hours laboratory—6500 miles cross-country flying—50 hours radio beam and blind flying. Transport pilot license—radio-telephone license and radio code. Extra rating on larger types of aircraft. Time to complete—44 to 50 weeks.

Special Transport Pilot's Course

205 air hours—400 hours classroom instruction — 500 hours shops, 75 hours laboratory — 4500 miles cross-country flying — 30 hours radio beam night and blind flying—transport pilot's license, radio-telephone license and radio code. Training on the larger types of good aircraft. Time to complete—20 to 24 weeks.

Limited Commercial or Private Pilot's Course

55 air hours—150 hours classrooms—150 hours shops—25 hours laboratory—500 miles cross-country flying. Radio-telephone license. Limited commercial or private pilot's license.

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Complete instruction on all aircraft instruments. Radio telephone and code license. 43 hours each week in classroom, shops and laboratory. A fine course and worthwhile to those who desire this technical training. Time, 44 to 50 weeks.

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Ryan has earned the title of "America's Most Modern School of Aviation." It is also proud of being the pioneer American Aviation School under original management.

RYAN STEPS AHEAD

Now Ryan steps ahead in double quick time with still further expansion in new building construction, new equipment, and larger faculty.

Construction is being rushed to completion on additional school buildings adding 7500 sq. ft. to the present school facilities. These new units will be devoted to airplane and motor mechanical training, including sheet metal shop, wood shop, welding shop, and drafting, with extensive new machinery and modern equipment of all kinds.

The Ryan Faculty is made up of men who are specialists of outstanding ability in their particular line. Three new instructors have been added to the staff this fall, bringing with them a wealth of experience. All technical and mechanical training is under the competent direction of that veteran aviation educator and aeronautical engineer, E. A. Ross, who has received international recognition for his outstanding work in aviation vocational training. Ryan School of Aeronautics, Lindbergh Field, San Diego, California.

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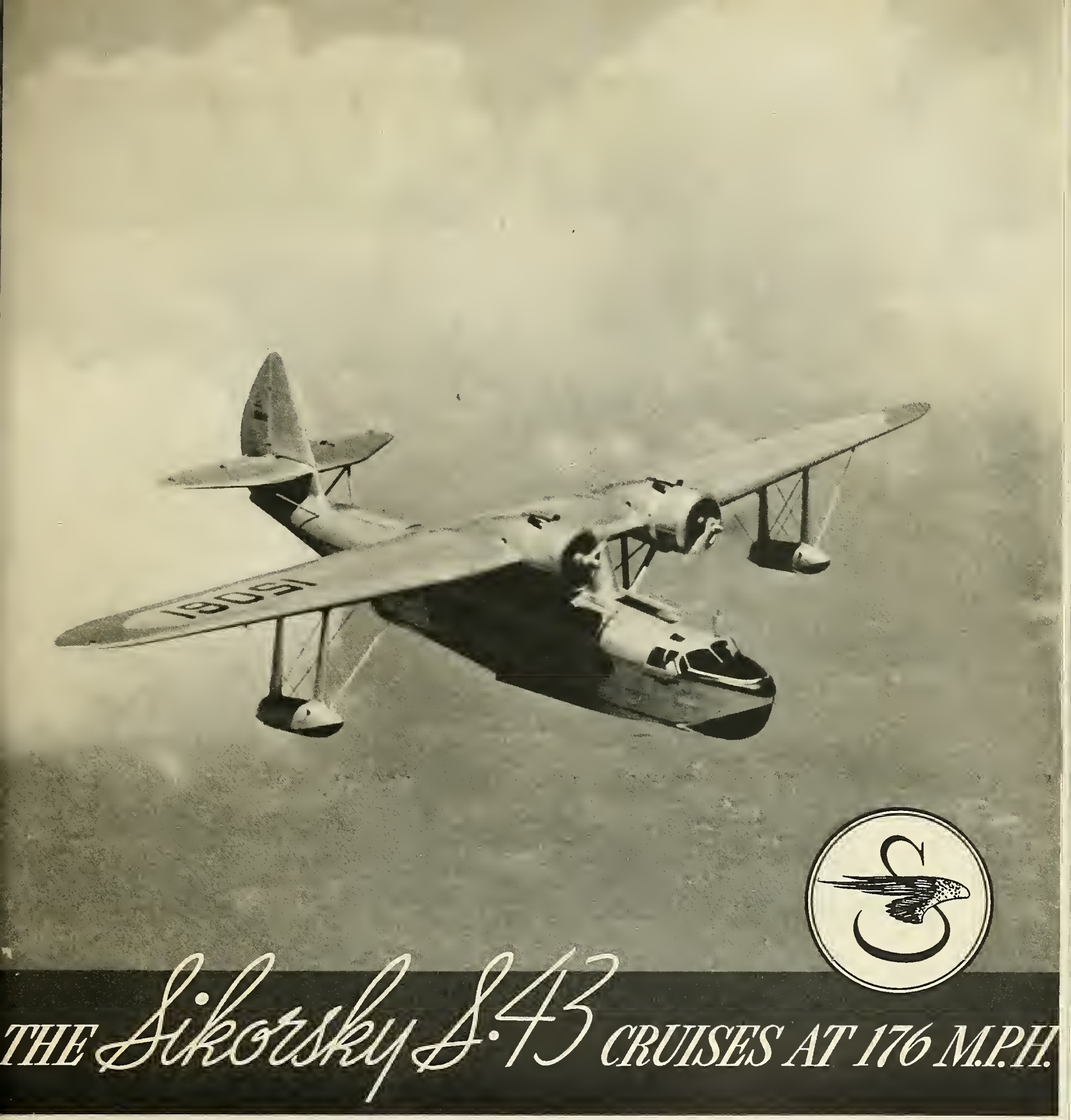

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Engines	750 H.P. Geared Hornets (S1EG)
Gross Weight	18,500 lbs.
Power Load	12.33 lbs.
Wing Load	23.70 lbs./sq. ft.
Cruising Speed, Sea Level, 75% BHP	163 mph
Cruising Speed, 1000 feet, 70% BHP	160 mph
Cruising Speed, 8000 feet, 75% BHP	176 mph
High Speed, Sea Level	182 mph
High Speed, 7000 feet	194 mph
Landing Speed, Sea Level	64 mph
High Speed, One Engine 2500 feet	115 mph
Initial rate of climb	1100 ft./per min.
Service Ceiling, 2 engines	20,000 ft.
Maintain altitude on one engine up to	7,000 ft.
Takeoff—Water	28 sec.
Takeoff—Land	18 sec.
Climb to 10,000 feet	12 min.

ACTUAL performance figures show how fully this brilliant new amphibion lives up to the expectation of its designers and builders. They give definite evidence of its possibilities for land and sea transport operation. At 8,000 feet this luxurious ship cruises at 176 miles per hour carrying 15 passengers, a crew of 3, and 1530 pounds of baggage, mail and express. Equipped with two 750 h.p. S1EG Hornet Engines and Hamilton Standard Constant Speed Propellers, this cruising speed is attained at 75% of rated horsepower. High speed under the same load conditions is 194 miles per hour at rated altitude.

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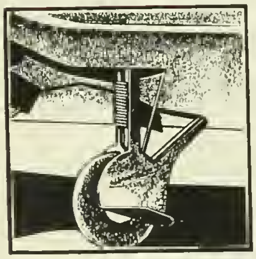

Beechcraft's retractable landing gear is one of the features which makes possible a four to one ratio between landing and cruising speed in Beechcraft model B17R. Lands at 50 m.p.h., Cruises at 202 m.p.h.

Make Your Own Fast Transport Schedules

Speed of the Beechcraft equals, often surpasses, speed of the big new air transports. It offers private fliers airline schedules "made to order." The business man who owns a Beechcraft is not restricted by set time tables, and out of the way places are as accessible as airline stops.

BEECHCRAFT PERFORMANCE CHART (*Guaranteed*)

	Engine	Propeller	Cruising H.P.	Cruising Speed (M.P.H.) and Altitudes		
B17L	Jacobs L-4	Wood	175	150 Sea Level	157 at 5000 Feet	161 at 7200 Feet
		Metal	175	155 Sea Level	162 at 5000 Feet	166 at 7200 Feet
B17E	Wright	Metal	210	165 Sea Level	173 at 5000 Feet	177 at 7200 Feet
B17R	Wright	Metal	285	185 Sea Level	195 at 5000 Feet	202 at 9000 Feet

BEECHCRAFT

» » a Finer Beechcraft

If You want Speed:

Beechcraft is the speediest airplane in its class ever built. It has made the map of the nation smaller. It is saving thousands of dollars in time for important executives.

If You Want Economy:

Consider Beechcraft's 11 miles per gallon of gasoline. It travels miles farther with no more maintenance or fuel cost.

If You Want Comfort:

The wide, deeply upholstered seats of the Beechcraft will appeal to you. The cabin is compact and yet four large people can ride in the Beechcraft all day (if the map is large enough) without undue fatigue. Plenty of leg room and elbow room are provided.

If You Want Safety:

In spite of Beechcraft's high speed it has a slow and safe landing speed; between 45 and 50 m.p.h. It can get into and out of small landing fields easily. Beechcraft is structurally sound and aerodynamically correct. It will fly itself.

If You Want Beauty:

Beechcraft's inverse wing stagger and its long sloping curved windshield give it an ultra modern appearance. Its lines are particularly adapted to unusual and striking paint designs.

If You Want Airline Performance:

Beechcraft pioneered the use of retractable landing gear for the private airplane owner, which has made possible performance comparable only to the performance of the fast transports.

If You Want Popular Price:

Beechcraft offers more for the money, in speed, comfort and maneuverability than any other airplane.

If You Want More Information:

Just have your secretary drop us a line. Specifications and performance data will be mailed you at once.

THE BEECH AIRCRAFT COMPANY, WICHITA, KANSAS

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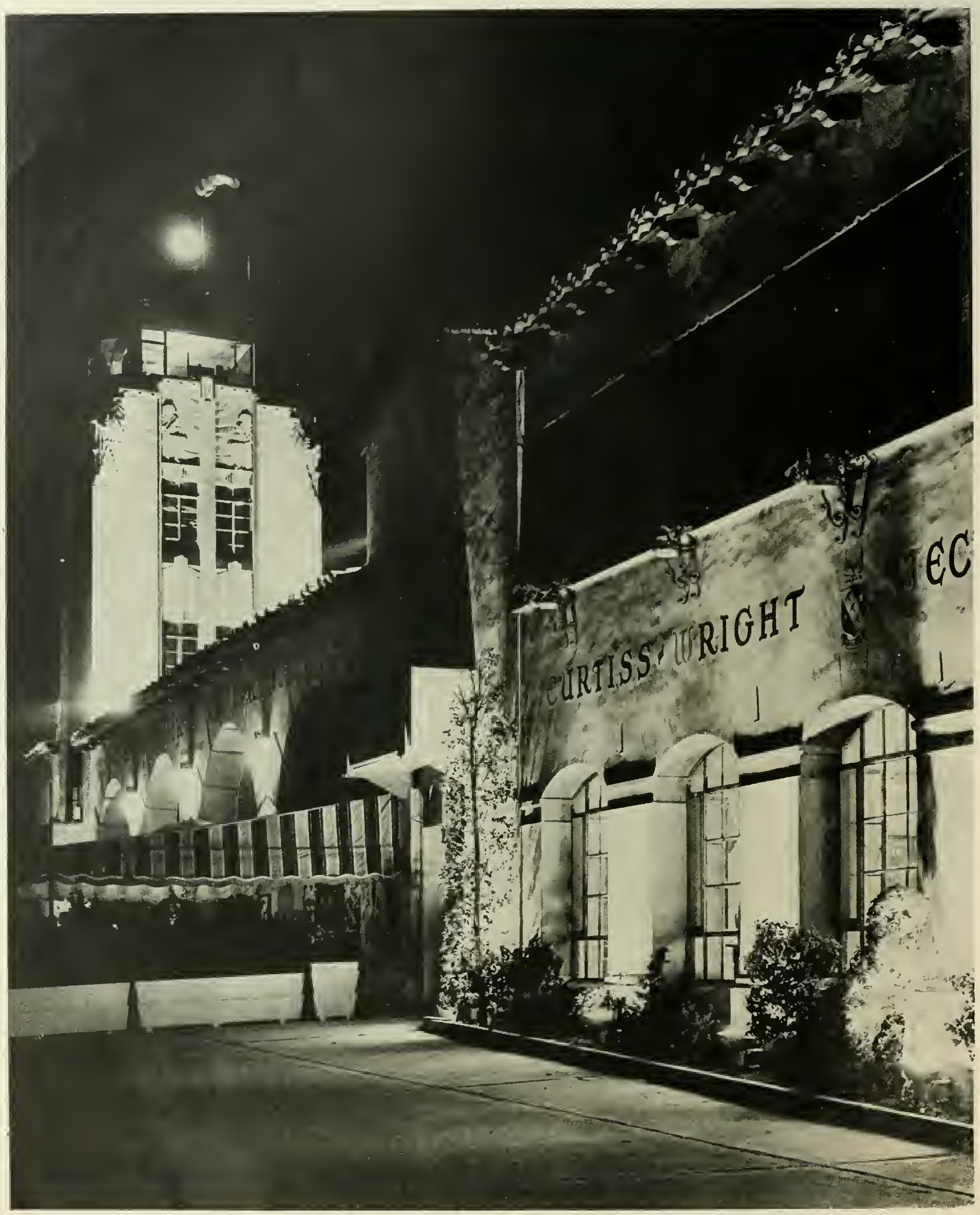


Curtiss-Wright Tech. Institute photo by Oelke

Night view of Glendale's Grand Central Air Terminal Administration building with its newly-installed indirect lighting system. Concealed lights illuminate the exterior of the building accentuating its attractiveness at night and giving it prominence so that it may be seen from most points in Glendale

AIR

HOT AND OTHERWISE

Something for Senator Nye to Explain Away.

●

FRANK A. TICHENOR

● What about it now, Senator Nye? What about all your pretty theories that it is the munitions manufacurers who instigate wars? Tell us, Senator, just how the "bloody hand" of these producers caused the present uproar over Ethiopia. Yes, Senator, explain it to us, for it looks to most of us benighted citizens that this fracas has been stirred up by factors entirely beyond the so-called influence of the munitions makers.

And it seems to many of us, too, that you and your fellow fanatics—in your zeal to make political capital by your fulminations against an industry essential to the protection of America—have threatened the backbone of our national defense. It is because of your rantings and ravings that such a noxious measure as the clause limiting naval aircraft profits was inserted in the Vinson naval construction bill. If the war contagion now plaguing Europe spreads to these shores, you can blame yourself if America is forced to defend herself with a weak and anemic aircraft industry instead of the healthy, vigorous one that the nation's welfare demands.

* * *

To every intelligent person who remembers the World War, the notion that armament producers are responsible for hostilities is patently absurd. Imperialist ambitions and the accumulating hatred of the people of one nation for those of another are the most frequent causes of war. If the munitions business in every nation of the world were socialized, if every last ounce of profit were taken out of the manufacture of armaments, there would still be just as many wars as ever, because nationalistic ambitions and hatreds would still be at their dirty work.

Let us not deceive ourselves—America is no more free from these factors than any other nation. We may not have the imperialistic aspirations of some countries, but we could easily become the victim of someone else's imperialism. Moreover, we probably have a greater talent for developing hatreds quickly than any other country. Look at us already—the minute trouble began brewing abroad, our citizens began taking sides. Our newspapers are full of letters from indignant persons denouncing the Fascists and Nazis. When freeing anti-German rioters, a city Magistrate comes down off his judicial perch to inveigh against the Hitler swastika. Editors the breadth of the land are beating their drums and stirring up a frenzy of feeling against Italian aggression and Nazi persecutions.

Of such stuff is war made! These ripples of public opinion, which seem so harmless now, can quickly build up into a great tidal wave that may sweep us into war. That's what happened in 1917. It can happen again in 1936 or '37 or '38. Just let a good, rousing scrap get going in Africa and Europe—then watch out lest we get ourselves all worked up to white heat over it. Right now, of course, we insist that we'll never let ourselves get involved again, that *this* time we're only going to be kibitzers. But we forget how quickly our kibitzing can become a violent and uncontrollable passion. If that happens, nothing that the President or Congress or the State Department may do can keep us out of war. The people will demand war—and they will get it.

* * *

This is the greatest danger that confronts America today. It is, unfortunately, a threat that we can do little to thwart without at the same time choking one of our most cherished rights—free speech and a free press. Since it is obviously impossible, and undesirable, to throttle the free expression of opinion in America, we must recognize the possibility that public hatred may pile up till it is so top-heavy as to topple us into war. Not only must we recognize that possibility, but we must face it realistically. And that means we must not allow ourselves to be misled by false prophets of the Nye variety. We must not let these zealots hoodwink us into acquiesing to such emasculating legislation as the Vinson Bill.

* * *

On the face of it, the Vinson Bill clause limiting the profits of naval aircraft constructors to ten per cent does not seem as vicious as it really is. On the contrary, it appears to be rather a good thing—because our memory of the wartime profiteer is still fresh. We learned then to resent the man who stayed at home and glutted himself with profits while $30-a-month doughboys wallowed in the mud and blood of France. The result is that we are only too likely to overlook the fact that there is a tremendous distinction between the profits of war-time and those of peace-time. During a war, a limitation of profits may be warranted. During peace, it decidedly is not.

In times of peace, the manufacture of aircraft for the military and naval services amounts to nothing more than routine setting-up exercises to keep in trim for any emergency which might arise. To limit profits is to lock the industry's arms and legs in stocks and prevent the free flexing of its muscles. How, then, can the industry be expected to keep in condition to meet whatever contingency may arise?

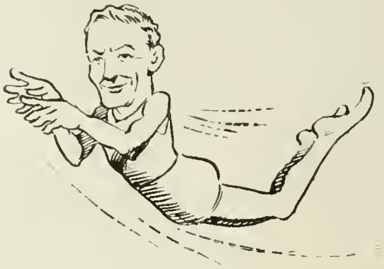
No matter what the New Deal brain twisters say, you cannot change the good old-fashioned law of cause and effect arising out of the profit motive. The promise of making a profit is what made America. Our greatest incentive to progress has been—and must remain—the prospect of increased gain therefrom. Men improve their products, they expand their plants, they risk their money in research and improved efficiency—all for the sake of enlarging their profits. Take that incentive away from them and they relax their efforts and content themselves with mediocrity.

Yet that, essentially, is what the Vinson Bill would do. By limiting profits to ten per cent, it would deprive aircraft manufacturers who build for the Navy of their best reason for going ahead and expanding their production facilities, improving their engineering and research staffs or even improving their aircraft beyond the barest limits of the Navy's specifications.

Only a fool could believe that this is the way to lay a strong foundation of national defense. Only the addle-brained could sit supinely by and watch the gathering clouds of war while we thus sap the strength of America's security.

THE MAN ON THE FLYING

By CY CALDWELL



● The late P. T. Barnum undoubtedly would have been delighted to own the three-ring Bureau of Air Commerce Circus, to which Colonel J. M. Johnson, recently appointed Assistant Secretary of Commerce, has fallen heir. What Mr. Barnum would have done with the Vidal, Martin & Cone Aggregation is fairly clear:—that great showman would have sent our amazing conglomeration of political and aeronautical talent out on tour under canvas, borrowing a detachment of United States Marines to keep order. In the Big Top, Vidal, Martin, & Cone, the three ring-masters, would have competed for popular favor; while before the Side Show of freaks and midgets a Mr. Giesse, hitherto practically unknown in aviation or the circus, would be acting as barker, calling attention to the $700 wonders within.

What Colonel Johnson will do with his show is a matter of speculation in which, no doubt, the Colonel joins. At least he intimated as much to me in a recent interview, stating that his mind, so far as the $700 airplane was concerned, still was open. My mind, and Vidal's mind, he remarked pleasantly, already had closed, so we were *ex parte* to the discussion. His neat way of eliminating two such stormy petrels as Vidal and myself from the prevailing turmoil delighted me; it proved that Colonel Johnson has a keen, analytical mind, capable of brushing aside conflicting elements and of concentrating upon an independent decision.

In this worthy purpose, however, Colonel Johnson is somewhat hampered by his own lack of experience in aviation; he perforce is bound to rely upon the technical judgments of others. He finds himself in the position in which an engineering expert would be if called upon to decide some controversial point in medical practice. The engineer would have to consider the opinions of medical experts, and, if they disagreed, to consult such a guiding body as the American Medical Association.

Fortunately Colonel Johnson, an Army engineer of outstanding accomplishments and with notable executive ability, has for his advisement in aviation just such an authoritative body as the one I have mentioned in medicine. He has the National Advisory Committee for Aeronautics, to which the Army, Navy, and commercial aviation goes with its problems. The N.A.C.A. is a non-political organization of aeronautical experts, engaged in research. Its findings are based, not upon guesses or political expediency, but upon fact.

Although I am *ex parte* to the discussion, nevertheless I make bold to suggest to Colonel Johnson that he consult the N.A.C.A. as to the utility of the various experiments now being fathered by the Bureau of Air Commerce, and then to decide for himself whether or not these experiments are so vital that, to further their favorable reception by the public, Mr. Eugene Vidal, Director of Air Commerce, is justified in attacking, either directly or indirectly by shrewdly calculated publicity, all of the airplanes now being manufactured by the American aviation industry.

To clarify our own position (not to Colonel Johnson, to whom I explained it thoroughly, but to our readers) I wish to reiterate in the plainest words that we of Aero Digest have no objection whatever to any experiment which the Bureau of Air Commerce is conducting. On the contrary, we are strongly in favor of the Bureau not only continuing its present experiments with light planes and engines, but of undertaking practical experiments in all phases of aviation. It must be remembered that the N.A.C.A. engages only in basic research, and that there is need for practical experimentation, in which, by the Air Commerce Act of 1926, the Bureau of Air Commerce is empowered to engage. But it is not given a mandate to foster its experimental department and to endeavor to secure funds for it by the vicious practice of casting reflections upon the safety of all airplanes other than its own purely experimental ones. That it uses such methods is a matter of common knowledge; and whether this hurtful publicity is disseminated by formal press releases from the Bureau or by the more effective means of press interviews, is beside the point.

In a recent talk with Mr. Vidal I stressed this matter of harmful publicity, and he stated that he had no control over what the Press might say about any subject. I had previously interviewed Mr. John H. Giesse, Chief of the Development Section, and Mr. Giesse had stated that he has frequently declared that his whole program is experimental and that he has made no claims to any startling success. As to the $700 airplane, Mr. Giesse remarked that it was his belief that such a price would be possible with a production of ten thousand or more planes yearly, and not otherwise. I repeated this statement to Mr. Vidal, who readily agreed with it. But when I asked him if he would issue a release to the Press stating in plain language that the entire development program was purely experimental, and that the $700 airplane built by mass production methods was not yet even in sight, he flatly refused to do so. "Why?" I asked. "Why don't you tell the truth about this thing?" He thought for a moment. "Look here," he said finally, "I'll bet you a hundred dollars that within a year an airplane will be built to sell for less than a thousand dollars!" What can you do with a man like that!

I gave up, and left him. Of what use was it to point out to an official capable of such odd mental processes that even if a plane *is* produced to sell for under a thousand dollars—which is possible—that the price still is almost half as much again as the mystic $700 which he has dangled before the flying fraternity? Upon my return from Washington I read in the Sept. 21 issue of *The Literary Digest* an article called "Storm Over the Flivver Plane," quoting parts of articles by E. E. Porterfield and myself, and concluding: "Vidal says: '$700 is a good figure and we will stick to it.' "

After mature deliberation I have come to the conclusion that it would be easier for the aviation industry to have Vidal removed from his position of Director of

TRAPEZE

Air Commerce than it would be to try longer to remove this mania for harmful publicity from his mind. I suggest that the industry make itself heard in the office of Colonel J. M. Johnson, Assistant Secretary of Commerce, whose Department includes the Bureau of Air Commerce. Colonel Johnson is aware of the dissension and strife within the Bureau, and he should be advised of the dissatisfaction with Vidal's policies which permeates the entire industry.

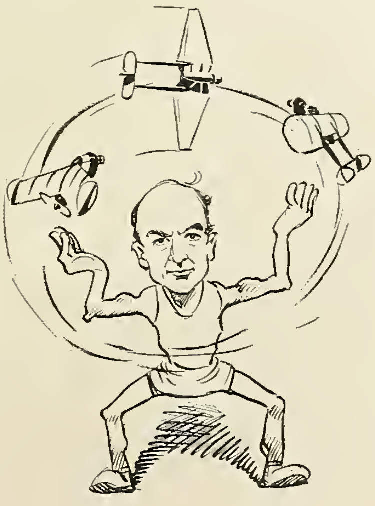
In this connection, however, I might point out that Vidal's position gives him such power over the industry that none but a few individuals dare to express publicly opinions which they express forcibly in private. This is especially true of the manufacturers, many of whom hope to sell airplanes to the Government or to receive experimental orders from the Development Section. They feel—and with some reason—that if they speak up that they will be blacklisted when purchases are made. Financial necessity forces many to take the prudent course of accepting uncomplainingly the ills under which they now labor, lest even more grievous ills be visited upon them by this petty bureaucrat, clothed as he is with almost dictatorial authority.

It is perhaps in order for me to place before Colonel Johnson and the industry certain matters which may help the Assistant Secretary to arrive at some satisfactory decision about the future policy of his Air Bureau; for by no stretch of the imagination can I convince myself that Colonel Johnson is satisfied with the present state of affairs. In doing this it is frankly my purpose to effect the removal of Mr. Vidal from a position of authority in which he has given satisfaction to few and dissatisfaction to many. And in this I declare that I am actuated by no personal feelings whatever against Mr. Vidal as an individual. The truth is that I like the man very much, and find him and his strange mental processes an interesting study. He on his part likes me—or so he declares; and I believe him. We get along splendidly together, and both of us have considerable fun as we volubly battle each other on some point of policy. There is no personal animosity on either side, be assured of that; simply, we do not agree about how the Bureau of Air Commerce should be conducted. And probably Mr. Vidal does not like the way that Aero Digest is conducted. On these points it is doubtful if we ever will see eye to eye.

To be fair to a brother in aviation, I should point out that Vidal has been handicapped from the start. He apparently, at least so far as we knew at that time, started on equal ground with Martin and Cone. Then he was elevated by the President to the position of Director, and they were left as his Assistants. John H. Giesse also was a contender for Directorial honors. I had included him with the hundred-odd contenders for the coveted position, but he informed me when I visited with him that he felt hurt that I had so slighted him—he was right up with the other three, he said, perhaps jokingly. Anyhow, there they all were, Athos, Porthos, Aramis, and D'Artagnan—the Three Musketeers and their pal the Director. It was a somewhat unholy trinity which he inherited, with knives occasionally in evidence, possibly for insertion between ribs, from the back. Poor D'Artagnan Vidal struggled along as best he could, sure of nothing but the general jealousies with which he was surrounded.

Now a really strong and forceful executive, faced with this situation, would have solved the problem in one of two ways. He would have disciplined his trio of political appointees, none of whom he had selected, and all of whom the President had appointed without consulting him; or, failing to discipline them, he would have resigned from an obviously untenable position.

He did neither of these things. He weakly compromised wherever he could, and, when the situation seemed to be growing intolerable he and the Musketeers resorted to somewhat less than straightforward tactics. The underlings on all sides automatically lined up behind their chiefs and heroes and acted as spies in the camps of the enemy; they also acted as unofficial under-cover press agents, buttonholing chance reporters and pouring grievous stories into their ears. Whispering campaigns started and made life interesting for all of the principals; if a Pressman visited one camp, a spy from a neighboring camp would drift in to overhear what he could. This entertaining system now is in full swing and affords considerable amusement to the visiting writing fraternity. The only trouble, from the reporters' viewpoint, is that he eventually arrives at a state of mind where he doesn't know who in hell he can believe.



I, for instance, am now in possession of enough information to condemn the whole quartet—if I believed it and could prove it. But I don't believe very much of it, and I couldn't prove any of it. The important fact for Colonel Johnson to consider is that this deplorable condition exists in his Bureau of Air Commerce; and that the Bureau will never rise to its former high place in the aviation industry's esteem and respect until this condition is removed, when we shall be happy to cease referring to Mr. Vidal and his menagerie as the Bureau of Air Belittlin'.

Do not think for a moment that I absolve others from blame and center my displeasure only upon Mr. Vidal. But he is the responsible authority; he is the man whom the President appointed to direct these others; and if he has failed to direct them successfully he has failed in his job. The first requisite of an important executive is that he should discourage petty jealousies among his subordinates and bend their naturally selfish ambitions to his will. But to do that, of course, he must be stronger than they are, not weaker, or they will turn his Bureau or his business into a caterwauling Kilkenny cats' back yard, which is about the state of dignity to which the Bureau of Air Commerce under Mr. Vidal's faltering direction now has descended.

As a single example, selected from several that I could mention, I take the case of Mr. Dennis Mulligan, largely because his name cropped up in my interview with Colonel Johnson, who informed me that I was mistaken when I said to him that Mr. Mulligan had been sent out to the TWA crash in Missouri to go over the head of Colonel Cone's inspector. Colonel Johnson replied that Mr. Mulligan was in Colonel Cone's Division of Air Regulation, and that therefore he could not be sent out without Cone's knowledge. Furtherfore, Mr. Mulligan had been on other crash boards with Cone's inspectors, and it was the usual procedure to send him. I replied that I would have to clarify my understanding on that point, and probably left with Colonel Johnson the impression that I had been mistaken. I now

(*Continued on page 102*)

EDITORIALS

> "Just as America leads the world in production and use of automobiles to our great financial advantage, so are we leading in many phases of aviation. Let us encourage the airlines. They are doing a good job,—a fine job. Capable and efficient executives are working day and night to give the public safe—sane—speedy air service. Our system is considered the standard of the world. Let us continue to build up air mail. Let us make next year Air Mail Year."
>
> —CHARLES P. GRADDICK, Superintendent of the Air Mail Service.

Back to General Washington's Day

● The brass hats in Washington who place a low value on faithfulness and flying ability and thereby forced Doolittle, Haizlip and Williams and others from the military service, are now doing the same thing to Sergeants William C. McDonald, Jr., and John H. Williamson, members of the team of the "Men on the Flying Trapeze".

Those who saw these pilots and their stunting companions, Major Chennault, and Lieut. Hansell perform this year and last at Cleveland, witnessed a most unusual exhibition of their daring and skill. The War Department however does not think McDonald and Williamson rate being officers because they failed by a narrow margin in a ground surveying test given this summer as part of the exams for new officers. It seems like going back to the horse and buggy days when admittedly competent military airmen are ruled out because they are not sufficiently proficient in an art in which the first commander, and Chief of the Army excelled, and which was so important in 1776.

Automobile Engines For Aircraft

● It was some eighteen or twenty months ago that the Bureau of Air Commerce announced that a $700 airplane would be available before long if there were sufficient numbers interested in the purchase of light planes for private use. The affirmative replies on the questionnaires that were returned, whether genuine or not, seemed to indicate that there was a substantial market for such a design if it actually existed and could be manufactured and sold for the price quoted or, for that matter, an even higher figure. Of course, those with manufacturing experience immediately recognized the folly of this pronouncement, but unfortunately there still are several hundred prospective airplane purchasers to whom this official joke has never been satisfactorily explained.

Now, it is customary for an airplane designer to give some thought to the power plant he expects to use before proceeding very far with the design of his ship. In the case of the elusive $700 airplane, this little item evidently failed to come in for its due share of consideration, or perhaps we should say—the only consideration, as far as anyone knows outside the official family, has been the conversion of existing automobile engines. Although it was announced at the beginning that a complete survey was being made of available power plants, it appears that this investigation was most superficial and any design which might conflict with preconceived notions on the subject of automobile engine conversion was purposely ignored.

There have been countless adaptations of automobile, motorcycle and other types of engines for the propulsion of aircraft from the very earliest days of mechanical flight. Some of these, particularly the small air-cooled motorcycle engines may be considered successful in so far as they delivered sufficient power for propelling these tiny light planes. Built primarily for sport, and races designed especially for them, and usually privately constructed, there was no logical reason for assuming the expense of developing a new engine. Furthermore, a new design built strictly to aircraft standards could not show marked improvements over these converted engines in either reliability or low specific weight.

However, when heavy water-cooled automobile engines are to be converted for aircraft use, the picture looks entirely different. This brings us into the horsepower range for two and three-place privately-owned or training airplanes, and the saving in cost of construction surely does not justify such a sacrifice in weight and reliability. At any rate, it is a rather significant fact that none constructed so far can be regarded successful in the light of average airplane performance, and it seems that the Bureau of Air Commerce has ignored all previous experience along identical lines.

It is evident that this program is based primarily on low costs, which everyone will agree is a fundamental consideration if flying is ever to come within the reach of the average citizen. The aim in itself is commendable, but the idea has been shared by everyone connected with aircraft as far back as can be remembered, so it is entirely lacking in originality. Results are what we are interested in, so the merits of this or any other engineering program must be judged on that basis alone.

Retirement of a Pioneer

● Major General Benjamin D. Foulois has retired. His activities since 1908 when he was detailed to the Signal Corps after ten years of service, would make a complete historical account of the growth of the U. S. Army Air Corps. First to fly a government dirigible balloon, first to pilot an Army airplane, Foulois proved the worth of the plane in actual military maneuvers as early as 1916 when he commanded an aerial squadron in the Mexican Punitive Expedition. His interest in his work, and his conviction that aviation was a coming military necessity were never better illustrated than when in 1910 he spent part of his modest income to make up a deficit incurred after the government's aviation appropriation was exhausted.

The Army loses one of its most capable officers and an accomplished gentleman whose talents may find better appreciation in civil industry.

Technical Advancement Fostered by Air Races

● For many years the record-breaking ship at the National Air Races was the forerunner of the fast pursuit or the speedy transport of the year after. If this is no longer true the answer lies in the difficulty which the small groups of constructors have in finding backers. But perhaps another reason lies in the lack of that international flavor to the speed races which was truly present in the Schneider Trophy races for seaplanes. Would not racing interest be greatly enhanced if a similar international trophy were estabilshed for land planes?

If the builders of racing ships are not able to finance entirely new designs each year, it is possible at least to maintain the process of cleaning up, perhaps adding a retractable landing gear, or a better fillet, or strengthening a tail surface spar, or removing some external bracing. Our impression was that some cleaning up still remained to be done on the racers.

One exception might be noted. Leader of the field in the Bendix and Thompson events, the Howard-designed *Mr. Mulligan* might well be the forerunner of tomorrow's private airplane.

The Case of the Automobile Engine for Aircraft

●

GLENN D. ANGLE

The conversion of automobile engines for aircraft assumes an important place among the projects sponsored by the Bureau of Air Commerce which have caused a great deal of harm to an industry needing all the possible assistance that a Government can give. It has shaken the confidence of those associated with aircraft in the men whose duty it is to serve them. Future worthiness notwithstanding, this experimentation is not helping the natural growth of the industry at the present time, because manufacturers are encountering sales resistance on every side as a result of the publicity permitted with regard to these so-called safe and cheap airplanes which customers are still being led to believe will be available within a short time.

● Aside from dependability, no characteristic of an aircraft engine is considered quite so important as low specific weight. Therefore, when one converts for aircraft use an automobile engine weighing five or more pounds per horsepower (to which must be added the weight of water, radiator, plumbing, reduction, gears, etc.) he disregards a fundamental requirement of good aircraft design.

In the case of a 100 horsepower converted engine with the above specific weight, for example, the complete weight undoubtedly would exceed 550 pounds. For a light airplane, a reliable aircraft engine of air-cooled variety should not weigh more than 2.5 lb. per h.p., or about 250 lb. for a 100 h.p. engine completely installed. This 300-lb. difference represents the weight of two passengers. Imagine how successful a manufacturer would be if he attempted the equivalent of providing seating capacity for two more persons in a conventional two-place airplane powered by a light engine delivering 100 h.p.

A recently announced airplane built for the Bureau of Air Commerce, and powered with an automobile engine of about 80 h.p., is reported to weigh 1075 lb. empty, which also is about 300 lb. more than is customary for any two-place airplane using an aircraft engine of approximately the same output. It is easy to recognize what a handicap this excess weight becomes in securing satisfactory performance and safety.

There are more phases to this weight question, but we will leave them for the moment to consider other essential features. Engine reliability is of paramount importance if we are to maintain safety in flying. We are told that these converted automobile engines are equally as reliable as modern aircraft engines, but this is a point that has yet to be proved. Tests of 50-hr. duration on one or more engines do not constitute sufficient evidence to justify such claims.

Surely, no one would expect to compare the operation of an engine in an automobile (on which most of the driving is done at half-throttle, or less) to an aircraft engine which operates from 75 percent to full throttle most of the time. Extra weight is no guarantee of reliability, and the use of finer materials and more careful workmanship must make some measure of contribution to the reliability for which aircraft engines have become so well known. There seems to be no other logical manner of reasoning for the present, so there is every reason to question such uncertain claims until they have been satisfactorily demonstrated.

It has been pointed out that service parts for these converted automobile engines may be purchased at low cost in practically every city and town in the country. This feature has attracted wide attention, and it may continue to appeal to a person until he has to wait sometime for the service station to send away for the needed part, just as they are required to do so frequently when repairing an automobile. However, one may eventually overlook the inconvenience caused by such delays, but he will never forgive a poor repair job by an unskilled mechanic when he is let down as a result in some remote place unfit for landing. Nearly every automobile owner has experienced difficulties of this sort at one time or another, but he is at least on a road where he can easily reach town and have his car towed to a nearby garage for repair.

Weight, Dependability, Cost

Although there are several other characteristics upon which the two types of engines under consideration may be compared, they do not demand as much special attention as the important features of low weight, dependability and low cost. From the weight standpoint, the converted automobile engine is greatly inferior. Also it is doubtful if it compares favorably with the modern aircraft engine for dependability. Therefore, cost is the only important feature in which it excells at present, so we must determine if the actual cost reduction warrants sacrificing the other essential features, and also if this is the only procedure by which less costly engines may be secured.

Low manufacturing costs in the automobile industry come through mass production, which is sufficiently large to write off the cost of the special tools and machinery necessary to turn out a large number of units with the minimum of wages paid to labor. The design of these automobile engines does not influence the cost factor to any appreciable extent; in fact, it probably works the other way because of the extra weight of the material used. But we shall come to that later. The question now is whether an engine designed specifically for light aircraft can be manufactured and sold at comparable prices.

No one ever has had the opportunity to prove whether or not this is possible, but careful consideration of the facts does not disclose any logical reasons why it cannot be done—provided, of course, that production is large enough to bring the man-hours of direct labor to the minimum possible. Without a careful time study of modern methods applied to some particular design, it would be unwise to venture an opinion as to the required annual output to attain this end.

All we know of the subject up to the present is that it would require many times the number of light aircraft engines that have ever been produced annually thus far. Hence, it resolves itself into the question of whether we must wait for sufficient demand to produce a suitable aircraft engine at the necessary low price, or proceed with such an engine in the hopes of creating demand and develop the potential market which is supposed to exist for light aircraft.

Design Competition

The aircraft market has not been sufficiently alluring thus far to warrant any manufacturer attempting such a speculative job, even if he were financially in a position to do so. The Government, which now is spending the sum $4,800,000,000 for various purposes, is our only hope as a sponsor of such a program. Suppose that $1,600,000 of this amount was appropriated for the development and production of 10,000 engines of about 75 h.p. We know that engine cost is the item of first consideration in the development of a low-priced airplane, and that such airplanes are not especially difficult to produce once a standard dependable engine is available at a price of, let us say, $2 per h.p.

Suppose then that a competition be inaugurated for engines of 75 h.p. which the party submitting the design must show by carefully prepared cost estimates that he can produce and sell for $150 per

(*Continued on page* 102)

Special Flight Problems Solved by Charter Service

O. J. Whitney's Service Adapted to All Demands

● Since its establishment in 1922, O. J. Whitney, Inc., Flying Service has developed into the largest charter service in the Eastern United States. At its base at New York City's Municipal Airport No. 2, North Beach, Long Island, a fleet of fourteen airplanes of various types is kept in readiness for carrying passengers anywhere, any time—day or night. Reserve planes are available when the demand warrents. This means, of course, the organization can supply land planes, seaplanes or amphibions, manned by experienced personnel especially trained for such service. These planes are equipped to fly in all weather, and, therefore, are provided with radio and instruments necessary for blind flying. The pilots, too, have had long experience in flying in all kinds of weather, over all types of terrain and in every type of land and water aircraft.

"Doorstep to doorstep" service is available when the patron wishes. All arrangements, including customs inspections, meals, the most expedient local transportation, and other services are provided for in advance, thereby relieving the patron of concern over details necessary to make complete trips in comfort. Charter operations are also conducted in the South during the winter months, based at Miami.

Orrin J. Whitney, active head of the organization, was formerly an instructor at the Naval Air Station at Pensacola, Florida, and has had more than 4200 hours of flying. He is assisted by William S. Gulick, a Naval Reserve pilot who has logged more than 2800 hours of flying; Carl O. Chader, also a former Pensacola instructor, who has flown for more than 2700 hours; and E. V. Reith who has put in at least 2200 hours of flying, is a graduate of Brooks and Kelley Fields, and is also a proficient Naval pilot.

Company personnel includes more than twenty-one full-time employees. Additional well-trained reserve pilots are available on short notice. Equipment is maintained in first class flying condition by a trained crew of mechanics under the direction of Alexander Garafolo, who is not only a licensed mechanic but also holds all flying ratings, including that of transport pilot. His duties for the past five years with Whitney have included test hopping of planes after they have been overhauled or repaired.

Charter service differs materially from service provided by scheduled airlines, for the company does not operate scheduled service to definite points. Speed is one of the essentials of charter service and in this connection the charter service occasionally has been faster than that of airline schedules. Many unusual charters are undertaken by this service such as carrying passengers on business and pleasure trips, aerial photography, transportation of news pictures, spare parts, medicines and other urgent supplies, as well as ambulance cases.

Rates for charter are based on the round-trip mileage between North Beach and the destination. Where this is not possible, an hourly rate is charged. Different rates are based on the speed and carrying capacity of the planes chartered. Additional charges are made for such items as "layover," "night flying," "over water flying," etc. For example, when a chartered ship arrives at its destination and the passenger wishes to retain it there at his convenience, the time it is held is termed "layover."

Charter trips of 600 miles or more round trip, are allowed a 24-hour layover without additional charge except for the pilot's living expenses during the layover. For each additional 24-hour period or proportionate fraction thereof, a charge is made of an amount equal to the cost of flying 150 miles in the particular ship used on the trip. If the charter is less than 450 miles, round trip, the passenger may have a 24-hour layover at the same charge, (an amount equal to the cost of flying 150 miles in the particular ship used on the trip). If the charter is over 450 miles but less than 600 miles, round trip, the total cost is equal to the cost of flying 600 miles.

Night flying is naturally more costly than day flying. The rate for flights made over recognized lighted airways is an increase of 25% over the day rate. Flights made over unlighted country,

Some of the planes in the fleet of O. J. Whitney's charter service, including four Beechcrafts

Pilots, executive personnel and mechanics of the O. J. Whitney Flying Service

either during part or all of the trip, increases the rate by 50%. If the flight is made partly by day and partly by night the extra charge is based only on the actual time flown at night.

The following incidents, a few of many in the everyday routine work of the Whitney charter organization, indicate some of the many ways in which this charter organization operates.

They were having trouble in the iron mines at Birmingham, Alabama—a strike and riot. It was necessary to have one of the leading officials at the scene immediately. The weather was extremely bad and there were no airlines running. A hurried call came from an airline, requesting a plane to carry one of the high officials to Birmingham, starting immediately. Within 25 minutes after the call, a plane was on its way with the official, flying blind for the first 250 miles. Within 7 hours elapsed time the trip was completed and the official was delivered at his destination.

It was 1:35 a.m. when the first news flash of the Morro Castle disaster came over the telephone to the company. The weather was exceptionally bad—low ceiling, heavy rain and fog. At daylight, six planes were dispatched to the location with news photographers, and during the day planes were flown out and about the burning ship, giving whatever news or help possible in the location of small boats.

It was 12:30 noon, and the owner of a department store had requested a plane to go to the scene of an automobile accident in North Central Massachusetts, 100 miles from New York. At 1:00 o'clock a plane was on its way with the party. Arrangements were made by telephone for automobile transportation from the closest available field to the scene of accident, and even lunch requirements were arranged over long-distance. One hour, thirty-five minutes from the time the telephone call was received, the party was at the scene of the accident.

The executive of a large business concern in New York found it necessary to be in Montreal in the quickest time possible. Necessary customs arrangements were made, and three hours from the time the telephone call was received this official and his men were on their way by automobile from the St. Hubert Airport to the city of Montreal.

Commuter Service

Commuters' service is arranged for single passengers or groups desiring a fast and dependable means of transportation between the home and the city. Arrival and departure points are New York's municipally-owned and operated seaplane ramps at the foot of East 31st Street and also at Wall Street.

Whitney's new Beechcraft seaplane

Sightseeing flights have proven popular from North Beach Airport, as it is only a short distance from the city. The "Air Ferry Trip," which takes about half an hour, goes to Newark Airport, back over New York Harbor to Floyd Bennett Field (New York's Municipal Airport No. 1), and returns to North Beach. A 15-minute trip is also provided; this comprises a trip over the Chrysler and Empire State Buildings at an elevation of 3000 feet. New Yorkers, no less than visitors to the city, have found this to be by far the most interesting way to realize the magnitude of the Metropolitan area, and enjoy its inspiring beauties as revealed from the sky. Other sightseeing trips are arranged to suit individual preferences at rates based upon the time required, the equipment selected and number of persons in the party.

At the North Beach base, weather reports are checked every hour (or more frequently in uncertain weather) and tabulations made in such form that pilots know immediately the weather conditions in every part of the country.

No incident, event, or flight report is filed until it has been considered as a means of improving the charter service.

Hotel travel porters, ticket agents, etc., are pepped up with occasional flights, visits to the base, etc., and made acquainted with the personnel. Hotels and ticket agents are provided with attractive display material, and complete rate and charter information in a loose-leaf reference book, indexed for easy reference and kept up-to-date by a regular service for that purpose.

The reference book gives a list of mileage to most cities in the United States and nearby Canadian cities, with notations enabling any agent to quickly figure the cost of any charter trip. In giving a quotation a "quote sheet" is filled out and kept as a follow up record until the flight is completed or notation made of the reason the trip was not made. These sheets serve as valuable references in computing future rates over the same course and as a means for constantly improving the service.

Nine telephone lines insure immediate attention day and night. Upon request, Cadillac limousines are dispatched to the city at reasonable rates to pick up and transport passengers to the airport. The base also may be easily reached from New York by subway, street car or by road.

O. J. Whitney is also a special investigator for aviation insurance companies, as well as the Northeastern distributor for the line of Beechcraft airplanes.

MARINE AIR TERMINALS

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GEORGE B. POST

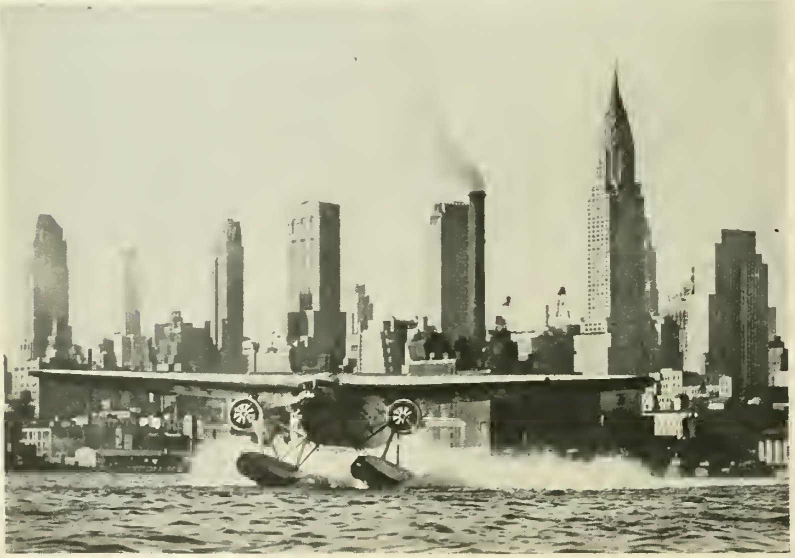
Chairman, Marine Air Terminals Committee
Aeronautical Chamber of Commerce of America, Inc.

● A year ago this fall the City of New York opened a new type of seaplane base at the foot of Wall Street and the East River for experimental operation. Christened the Wall Street Skyport, it became the first municipal airport on Manhattan Island and brought the advantages of air travel closer than ever to the business heart of a great city.

Much has been written on the subject of seaplane bases during the intervening year, and with the movement growing, it seems proper to review the development and examine the facts which are beginning to emerge. Some classification should probably come first. Airlines such as Pan American Airways, which operate over great bodies of water and compete principally with steamship travel, require seaplane bases as their terminals for landing passengers and storing and maintaining equipment. These international bases, however, appear to be needed only at a few ports of entry. They must generally be designed especially to accommodate the huge craft which are best adapted for this type of service, and probably would not prove practical in handling the average seaplane or amphibion. For these reasons this type of base will not be considered in this discussion.

Viewed in the light of a public utility the construction of a seaplane base is a most economical way in which the average waterfront city can encourage faster and more convenient air transport service. It appears that the soundness of this program is being at last recognized, since marine air terminals at the present time are under contemplation or actual construction in many parts of the country and the advantages of the doorstep water landing is becoming an increasingly important part of the air transport picture.

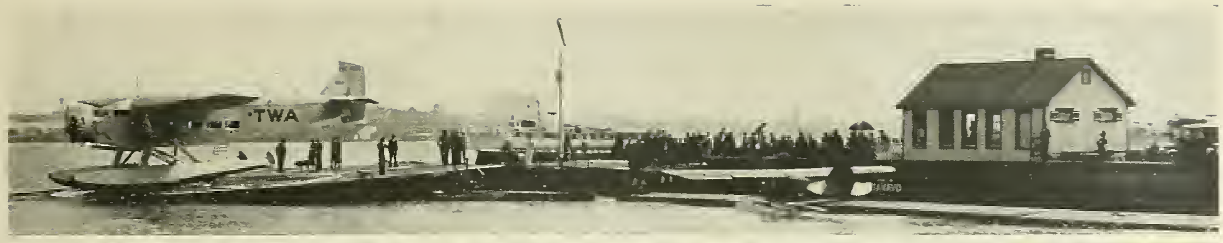
There are other types of seaplane bases, however, which are needed in every city adjoining a reasonable body of water if the true worth of air transport is ever to be fully realized. In this case, the water flying craft which use them will be competing with busses, railroads, and other airlines using land planes, or a combination of all three services. Their success will depend almost entirely on their ability to land on the water and get their passengers ashore at the business or residential centers in the shortest possible time—ahead of those who come by train or bus.



TWA's tri-motored Ford taking off from the Midtown Skyport

Marine air terminals for this type of service must be placed at the centers of population, for they would lose their value if located in the outlying districts. Furthermore, they must be equipped to handle all types of ships with the utmost speed and efficiency. A recent survey by the Marine Air Terminals Committee of the Aeronautical Chamber of Commerce of America, indicated that 220 cities in the United States with populations of 10,000 or over are adjacent to adequate water landing areas and could greatly benefit by marine air facilities. Yet it is only within the past year that any widespread movement to provide them has taken place.

Before analyzing the types of bases most suitable for various conditions, let us consider the operations they would ordinarily be expected to serve. A survey of present activities in the vicinity of New York offers an excellent example. During the last week in June of this year, Manhattan's two skyports—at Wall Street and 31st Street on the East River—were opened for regular use. These bases are primarily passenger terminals. They can accommodate all sizes of ships including the large transports but do not incorporate storage and hangar facilities. In July (their first full month of regular operation) the records disclose that 543 passengers arrived or departed from their gangways, while during August the number had increased to 712. In this same period 16 different types of seaplanes and


New York's Midtown Skyport. A Ford seaplane is on the turntable ready to be floated off, and an Aeronca seaplane is moored at the landing float

amphibions ranging from the Aeronca to a nine-ton bombing seaplane used the floating turntable ramps.

Four ships have been used in regular daily commuting, from Bridgeport, Lloyds Neck and Oyster Bay, and a number of other planes have been flown intermittently in the same type of service, some privately owned and others from charter operators. Sight seeing flights have been consistently made during the middle of the day, while the carrying of newspapers with Wall Street closings to some of the waterfront suburbs has proven popular as a daily operation. In addition, student instruction, solo pleasure flights, and charter trips ranging from 5 to 500 miles, have been carried out. It seems obvious that the ability to safely and consistently put passengers ashore on the city's front door step has developed uses for aircraft in this area which otherwise could not have existed.

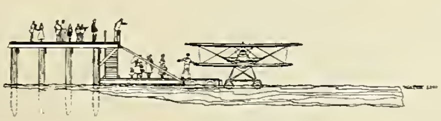
Having demonstrated the possibilities of the bases and the practicability of river and harbor flying in the New York territory it is logical that the advantages of the water landing should finally be incorporated in the general air transport picture, and steps to this end are under serious consideration at the present moment. Lines from New York to Providence and Boston, New York to Atlantic City, New York to Philadelphia, Baltimore, and Washington, and even New York to Cleveland and Chicago, all are within reach of the doorstep landing with existing equipment. In the case of New York and Philadelphia, for example, the actual city-to-city time could easily be halved as compared to existing rail or airline schedules.

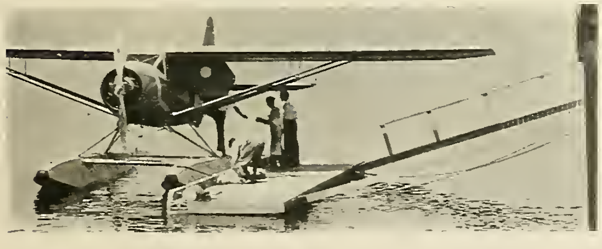
TWA, first of the major airlines to prepare a seaplane for service in this area recently equipped one of its tri-motor Fords with floats and will place the ship in operation at the 31st Street Skyport. In this instance a land plane outdated for regular airline use, was found to have practically ideal characteristics for short haul flights from the water, and to lend itself to the shuttle service which is contemplated to the outlying airports. TWA has announced that its ultimate intention is to land its passengers where they want to go—on Manhattan Island—and the preliminary operation of its low cost, 14-passenger seaplane, will be watched with interest.

Seaplane bases being considered in this article may be conveniently divided into two general classes—bases for storage and maintenance, and passenger terminals. In smaller cities the two types are usually combined in a single location but in large municipalities the value of waterfront property close to business or residential centers may be so great that even the limited space required for hangars and repair shops would prove prohibitive. In such cases, railroading principles are followed. Passenger terminals are placed at the center of population, while storage bases, like the ordinary airport, are located in outlying districts. This planning has been followed by the City of New York in the development of its turntable ramps and landing floats, under Deputy Comm. Zelcer's direction, and the municipal airports at North Beach and Floyd Bennett Field are intended to provide the necessary storage and maintenance facilities.

Under the heading of passenger terminals, the simple landing float is undoubtedly the cheapest and most satisfactory arrangement for handling small ships up to possibly the 6- or 8-place types. These units are generally constructed of wood with gasoline drums or fuel oil tanks providing the bouyancy. They should be designed to have a freeboard of not more than 12 to 18 inches so as to make it easy to get under the wings of a small plane which is tied alongside them. They are held off the side of the pier or dock by booms and cross chains, with a gangway giving access to shore. All types of modern water flying craft with water rudders, can conveniently operate from such floats if placed in reasonably protected waters, and the ships may be brought alongside and fended off with sections of automobile tires for bumpers.

Floats of this type are used to supplement the turntable ramps at both municipal bases on Manhattan Island; at the Marine Air Transport Base in the Hudson River at 155th Street; at the New Bedford, Woods Hole, Martha's Vineyard, and Nantucket bases of the Island Airlines; at the Boston Airport; at Rockland, Maine; at the Edo base in College Point, Long Island; and in many other parts of the country. Similar floats are either contemplated or under construction in a number of other cities in the east including Washington, Newark, and Yonkers. A single float, with booms and





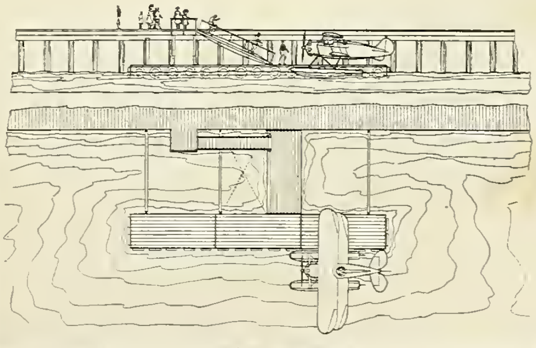


Figure 1. (Left) Bellanca Pacemaker alongside Edo float at College Point.
Figure 1a. (Above) Passenger landing float for small aircraft

gangway may cost less than $300 completely installed (illustrated in figure 1). The unit shown in figure 1a with a 60 to 70 ft. frontage could be placed in operation for less than $1000.

Bases of this nature are cheap to build and can be constructed at any local boatyard. They are easily pulled out in the winter for overhaul, painting, and to prevent damage from ice, and are inexpensively moved from one location to another whenever desired. If serviced with aviation fuel and oil, or better still if backed up against a waterfront automobile filling station which carries them, such bases represent the first step in providing the minimum seaplane requirements.

Where the large transports of from 10 to 20 or more passenger capacity are to be handled, it has been found that the simple type landing float just described does not prove adequate unless the ship is tediously warped in under precise control, since the momentum of a heavy plane moving under its own power and without the benefit of reverse gear would make docking risky. As a solution to this problem whereby the large ships could be brought in with minimum personnel and maximum rapidity, the floating turntable ramps as used at the New York Skyports were developed by engineers of United Dry Docks, Inc., from specifications prepared by the Edo Aircraft Corp.

These terminals (figure 2) consist of a float 85 ft. long and 45 ft. wide supported by bouyancy tanks at both sides and either end. The structure is of steel, decked over with heavy creosoted planking. One end is built to an average slope of about 1:9, and incorporates a 45 ft. turntable, flush with its surface. Large reservoir tanks and a small air compressor provide means of quickly altering bouyancy in the tanks under either end, so that the waterline as well as the slope may be rapidly varied at will. A 20 h.p. electric motor controlled from an operating pit at the head of the float operates the turntable at speeds up to 1 r.p.m

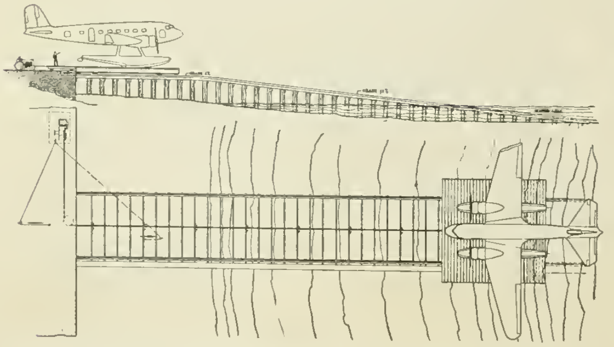
Bellanca Airbus Seaplane and a Fleet at Wall St. Skyport

In operation, these floating ramps are rigidly secured to the side of a pier or bulkhead with hinged booms which permit them to rise and fall with the tide. The turntable is normally set with the waterline at its center, and amphibions or seaplanes taxi in and go aground on the turntable on their wheels or the keels of the floats. Here the sloping surface acts as a brake permitting the ships to safely taxi in with sufficient power and speed to maintain control even with strong winds and currents behind them, a condition which would render the use of the ordinary landing float impossible except with small machines.

As the ships drive in on the turntable they maintain position with engine power until the table has been rotated 90°. During this operation, if the ship is an amphibion, the wheels are chocked fore and aft and the lower portion of the turntable is raised out of the water while the turn is being made. The whole manoeuver including a full 180° turn is accomplished in from 20 to 30 seconds and within less than a minute from the time contact is first made, the loading steps are placed in position and passengers are ready to leave or enter the plane. When returning the ships to the water the lower end of the turntable is submerged, so that they are gently floated off or if desired they may slide down into the water under their own power.

Passenger terminals of this type are the most efficient yet developed for rapidly handling large amphibions or seaplanes. Since they are a floating unit they need not be especially designed for any particular location but may be moved about as necessity requires. They are the most compact arrangement for handling large machines, and take up the smallest amount of space in congested areas. They permit locating the terminal between docks and inside the pier line where through their ability to receive ships under speed, and swiftly turn them about they make possible operations which could not otherwise be considered. The docking operation is carried out with engines running, making it possible to burn out the gas and eliminating the risk of cutting switches on overheated motors. A further advantage of this terminal lies in the fact that as a complete floating unit it could, in the event of a national emergency, be taken over by the Army or Navy, towed to a secluded harbor, and if suitably camouflaged be made to serve as a mobile and most difficult to locate base for water landing coast defense aircraft.

The floating turntable bases used in the New York Skyports cost less than $70,000 each, completely equipped, but exclusive of waiting rooms, and other accommodations provided on shore. They were built as a relief project under comparatively difficult conditions and were the first of their type to be constructed. It is estimated, therefore, that similar bases could be placed in use for approximately $50,000. Considering that bases for this type have a capacity to handle from five to ten large transport ships an hour their cost is small compared to the



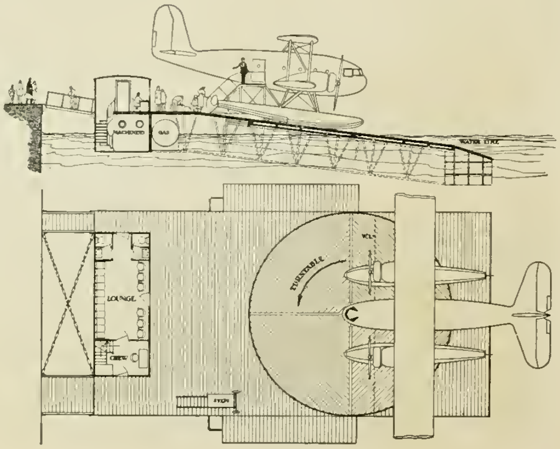


Figure 2. (right)—The floating turntable ramp—a passenger terminal for large transports. Figure 3. (above)—A marine railway for storage bases

purchase price and development cost of property for the average municipal airport.

In the past, storage and maintenance base facilities almost invariably were provided by building a wooden or concrete ramp alongside some waterfront airport. Combining the same hangars for land and water operations has many advantages where this arrangement can be followed, but unfortunately, many airports have been laid out without fully recognizing the uses to which the ramp would be put. Ramps, for example, are really best suited only for amphibions, and amphibions would naturally choose the airport to land on rather than using the ramp after landing out on the water. Other mistakes frequently encountered include the building of ramps on the opposite side of the airport from the hangars, and the use of concrete (instead of wood) with its attendant damage to the keels of seaplanes and flying boats. Where serviceable ramps are already at hand, they can be satisfactorily used in combination with beaching wheels and a number of types of recently developed beaching dollies, but where the construction of new seaplane facilities is contemplated, the marine railway is recommended.

Figure 3 illustrates a type of marine railway which is planned for use at a number of projected seaplane bases along the Atlantic coast. It consists of rails supported on wooden or concrete piling and carrying a heavy steel car from 30 or 40 ft. square, surfaced with creosoted wood planking. The outboard end of the car should be held higher off the rails than the inboard end, to give it a wedge-shaped appearance. The angle of this wedge should match the slope of the rails at their upper end so that the car is level in this position, while the slope of the rails should increase as they enter the water. This arrangement has the advantage of shortening the overall length of the railway and reducing under water construction. At the same [illegible]

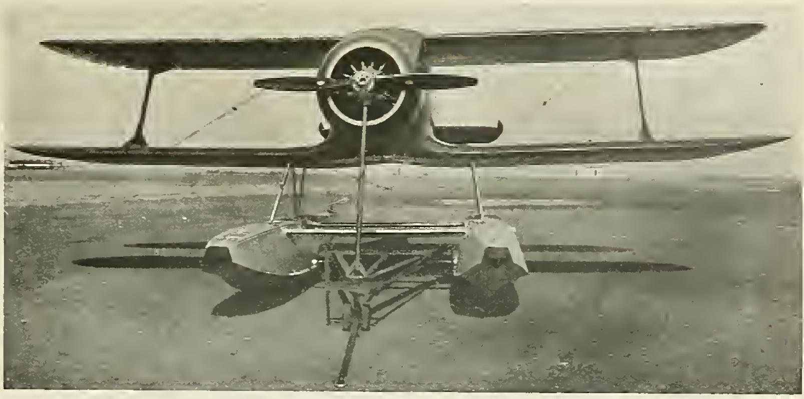


Figure 4. Edo beaching gear hauling a Jacobs-powered Beechcraft seaplane

slope to insure the car running freely to the end of the rails by gravity, even with mud or refuse on the tracks, and achieves the desired slope of about 1:9 on the surface of the car when set partially under water in position to receive a seaplane.

In using the railway, the car is lowered until approximately two thirds of its surface is under water, presenting generally the same effect as the sloping surface of a floating turntable ramp. Seaplanes taxi in under power, go hard aground on the wooden surface, and maintain position with half throttle. The car is then raised to the top of the railway by an electric winch without the need of anyone entering the water. At the head of the railway the seaplane is slid on the keels of its floats to a small platform dolly by another cable from the same winch or the usual airport tractor. The dolly is supported on roller casters so that the ship may then be conveniently pushed around in any direction and removed to the hangar. When returning to the water, the seaplane is slid from the platform dolly to the railway car by a snatch block and cable. The engine is then started, after which the car is lowered into the water until the ship floats off and taxies away.

This arrangement is superior to the conventional ramp for the handling of seaplanes and flying boats. In the first place it is cheaper to construct and much cheaper to maintain, particularly where bad ice conditions are encountered since during the winter the car may be drawn permanently out of the water so that only the rails and their supports remain exposed.

The marine railway makes it possible to handle even the largest ships with minimum personnel, only the pilot of the plane and the operator of the winch being required. The railway illustrated in figure 3 has a 40-ft. car and would be suitable for handling the largest transport seaplanes, running up to perhaps 20,000 lbs. gross weight. A 30-ft. square platform, however, would probably do satisfactorily for the average seaplane base and it is estimated that under ordinary conditions an installation of this type can be built for $5,000 to $10,000. Marine railways of this type, in connection with a string of landing floats would make ideal equipment for the average city. Moreover, they need not necessarily be built as a unit, since it would be practical to have the landing floats at the business center, with the railway and storage hangars a mile or so down the

(*Continued on page* 101)

is spent for land.

rough rolling country that is wooded in parts, it is particularly important to study these wooded areas along with the open fields since the most level and economical parcel to develop may be hidden beneath the trees. Often we have observed excellent wooded sites passed over in favor of open fields although the cost of clearing, grubbing and grading a wooded area might be considerably less than the cost of putting an open field in shape. In this connection valuable information can be obtained from the United States Geological Survey quadrangle maps covering the areas under consideration. These can be obtained from the U. S. Geological Survey in Washington or from a local store selling maps and engineering supplies.

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NOTES ON THE SELECTION AND DESIGN OF LAND AIRPORTS

A. P. TALIAFERRO, JR.
Airport and Air Transport Consultant and Engineer

The subject embraced in the title of this article is a broad one and many-sided. Obviously space does not permit more than a bare sketching in of the outlines of the problems involved in selecting a site for an airport and planning the grading, draining, and surfacing of the landing area. However, the country is embarking on another burst of airport development brought about by the $4,880,000,000 appropriation for public works and work relief. We are glad to set down what seem to us high lights on the subject with the hope that they may be of some assistance in producing better airports for the funds expended.

● The term airport covers a wide variety of ports, just as the term road indicates everything from a multi-lane express highway to a farmers' secondary road. Unlike the motor truck or car which can negotiate almost any sort of a roadway worthy of the name, large transport airplanes require more room to land and take off than do the small sport types. With the vehicle operating in two dimensions and a comprehensive fund of data available, developed through the construction of roadways since the days of the Romans and before, highway construction is a comparatively simple field of engineering. On the other hand, airplanes operate in three dimensions and the following variables (with the exception of the last, disregarded by ground transport) are important with scheduled air transport.

Type of aircraft to use the port
Day or night operation
Wind direction and force
Altitude above sea level
Stability of surface.

(A high grade surface comparable to an improved roadway surface will permit a plane to get into the air much more rapidly than would be possible on a rough, heavy turf. Less area is required for a field with runways than is necessary with an unimproved surface.)

Each airport problem is an individual one and calls for an intimate knowledge of the why and wherefore of the airplane and sound knowledge of the basic engineering involved in clearing, grubbing, grading, draining, paving, landing area, and the installation of lights, radio communications, and hangars. The engineer who knows little or nothing of flying is liable to make a mess of the job as a whole although the details of his work may be satisfactory, and the pilot with slight contact with the difficulties and costs of construction may, and frequently does, suggest plans that look well enough on paper, but are far without the realm of possibility when the cost is considered.

Until recently the Department of Commerce rated an airport, regardless of where located, upon the application of the owner. This practice has been abandoned and the Government now studies each airport located on an interstate carriage of passengers individually, with the factors listed above in mind. It says what types of aircraft may use the port in question, whether day and night operation are in order, or day alone, and in general approaches the problem of regulation with a pilot's common-sense attitude. The Government through its power to regulate interstate commerce can dictate to the interstate airplane in commerce, but it has as yet not entered the field of regulation of the intrastate airport, although this airport may serve as part of an interstate system.

Selection of the Site

The airport should be as close to the center of the community it serves as may be consistent with safety and cost. The distance from the point where mail, passenger, and express business originates, however, should be time-distance and not merely mile-distance. Time-distance is the measure of the time required to reach the site by an accepted mode of ground transport, usually an automobile. It takes into consideration the character of the roads traversed, grade crossings encountered, and traffic congestion along the route. Obviously a road capable of supporting heavy vehicles should lead to the site or be included in the airport plans.

The problem of locating a site for an airport can be substantially simplified by rounding up all existing data on wind and weather, highways, ground contours, and property ownership. The nearest United States Weather Bureau office has on file the facts and figures about wind conditions, visibility, and rainfall that [illegible] the layout of

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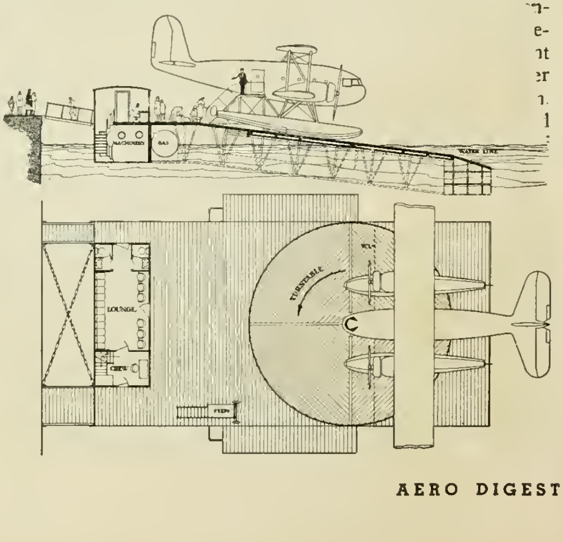

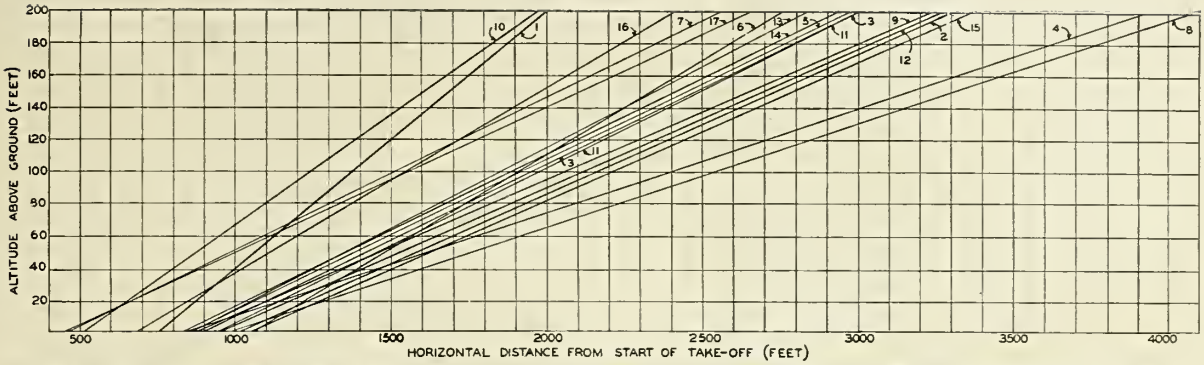

Take-off performance of typical airplanes at sea level altitude. Approximate effect of change in altitude on take-off characteristics assuming no change in available power: (a) Take-off run is increased 3% for every 1000 ft. increase in altitude. (b) Climbing angle is decreased 1% for every 1000 ft. increase in altitude. If unsupercharged engines are used the loss of power with the increase in altitude will further increase the take-off run and decrease the best climbing angle in addition to the changes noted above. Approximate effect: (a) Take-off run is increased 8% for every 1000 ft. increase in altitude. (b) Climbing angle is decreased 6% for every 1000 ft. increase in altitude

federal airways or logical feeder routes as may be possible. The time-annihilating speed of the airplane, however, makes this less important than the problem of getting to and from the airport on the ground. To repeat, time is the only measure of distance with air transport and an hour spent in the weary traffic of congested streets will mean 300 miles placed behind the airplane of tomorrow.

From this point on we are concerned largely with the cost of preparing the landing area. With unlimited funds it it not difficult to make an airport out of almost any piece of ground, as witness the Pittsburgh-Allegheny airport which was brought about by literally blasting off the top of a mountain; and witness the proposal, which daily becomes more reasonable, to bridge over railroad yards, storage warehouses, or similar sections with elevated landing strips that will not interfere with the use of the ground below and bring the airport substantially closer to the city. Unfortunately, however, unlimited funds are seldom available and the community usually has to cut its cloth to fit its pattern. This fact emphasizes the necessity and importance of having engineering studies made of sites under consideration [illegible] any money is spent for land.

In rough rolling country that is wooded in parts, it is particularly important to study these wooded areas along with the open fields since the most level and economical parcel to develop may be hidden beneath the trees. Often we have observed excellent wooded sites passed over in favor of open fields although the cost of clearing, grubbing and grading a wooded area might be considerably less than the cost of putting an open field in shape. In this connection valuable information can be obtained from the United States Geological Survey quadrangle maps covering the areas under consideration. These can be obtained from the U. S. Geological Survey in Washington or from a local store selling maps and engineering supplies.

The Airport Plan

In order to intelligently design ground facilities for the airplanes that are to use them, we must know the performance of these airplanes. Accompanying these notes is a chart which gives, for the first time in this particular form, a graphic picture of the take-off runs and climbing performances of 17 representative American airplanes. Numbers 1-7-10-14 and 17 are single-engined airplanes of the private owner and taxi service type. The other curves depict the performances of transport aircraft, all of which are now in operation in this country.

The airport designer is vitally interested in the most critical performance that may be expected from aircraft using his port. The Department of Commerce requires that transport airplanes take-off within 1000 ft. and land at not more than 65 miles an hour. Evidently from our chart we can expect all transport aircraft to get into the air in something like 1000 ft. Number 8 appears to have the flattest climbing angle and requires the most airport in which to operate safely. The curve on this particular airplane indicates that at 2000 ft. from the point of take-off, an altitude of 130 ft. will have been attained. At 3000 ft. from the point of take-off it will have climbed to 196 ft. This points to the necessity for controlling obstructions around the landing area and also to the fact that at least six-way effective runs 3000 ft. in length should be provided.

Airport landing areas vary in lay-out from the simple T, X, or L, with legs 250 ft. or more in width, and from 1800 ft. upwards in length to the large area that theoretically at least provides landings and take-offs in all directions. The planning of the small field is naturally not as complicated a problem as are the plans for a terminal airport; however, it cannot be emphasized too strongly that before a shovelful of earth is turned on even a small development, there should be a comprehensive plan that will provide for expansion, anticipated future drainage and lighting requirements and the location of hangars, parking areas, etc. The fundamental beginning point of such a plan is a layout that will handle the maximum number of plane movements with safety in a given period of time. Runways are an integral part of the layout, not alone because they provide a superior surface, but because they serve to organize and regulate aerial traffic. Airplanes can operate at close distances provided their pilots know what to expect from the other fellow. As air traffic increases important airports will have to become more efficient. Otherwise, communities will have to build more airports. The trend points unmistakably to single or double runways with *all* traffic required to stay on these runways at all times. When this comes about, if the runway system is properly planned so that taking off planes can reach the point of take-off without choking the runway and landing planes can be quickly cleared after they have made contact with the ground, movements will follow each other with increasing rapidity and headways will be actually less than if operations were spread over a much larger, but unregulated, area.

Grading and Drainage

Having established the basic runway plan, grading and drainage can be developed to fit into the coherent unit.

The Department of Commerce in a recent bulletin entitled, *Airport Grading and Drainage* has this to say: "The landing area is the foundation of the entire airport structure and its conditioning and development for all weather use are of prime importance. In general, an airport should provide a smooth, well drained landing area sufficiently firm to permit safe operation of aircraft under all ordinary weather conditions, and should be approximately level and free from obstructions or depressions presenting hazards to aircraft operation. The landing area should be sufficiently smooth to permit a light weight automobile to be driven over any part of it at a speed of 30 miles per hour without undue discomfort to the occupants. If grading is executed in accordance with an unsuitable plan and additional work must be done later, heavy costs for reconstruction of both drainage and surfacing are likely to occur. A master plan for the entire landing area should therefore be developed before any work is performed in connection with any part of the project. In a similar manner, the drainage plan should be completed before any work is performed on the field, for in working out the drainage plan it may be necessary to make some alterations in the proposed gradients of the field."

The same publication states with respect to the allowable grades that they "should be in even, smoothly flowing lines, and designs should be worked out based on profiles with *maximum* grades of not more than 3% along the line of a runway and no greater than 1½% change in grade per 100 ft. Transverse grades across a runway should not exceed 4%, with not more than 2% change in grade per 100 ft."

These grades are maximum (the italics are ours) and are not recommended as ideal. Particularly in the case of hard surface runways the 2% allowable maximum grade is liable to introduce quite a bumpy condition for the airplane crossing the runway at right angles as this grade permits a crown (either positive or negative) of one foot in a 100-ft. runway or 1½ ft. in a 150-ft. runway. Half of this, or 1%, should be adequate for any type of pavement. Experience indicates that the crown should be as flat as possible with adequate run-off of water guaranteed. Bituminous runways require slightly greater crowns than those made of cement concrete in order to obtain a satisfactory run-off.

The character of the soil will have considerable to do with the gradients established. If the soil is made up largely of sand gravel, water is not liable to accumulate on the surface to any great degree. With this kind of material to deal with surface run-off is not so important and grades may be flatter. On the other hand a heavy non-pervious soil does not permit the water to find its way rapidly to the sub-drainage system and the gradients of the field must be carefully calculated so as to route surface water off the landing area as rapidly as possible but not so rapidly that excessive erosion will result.

The lighting of the landing area is also an important consideration in establishing the grading plan. Current systems of flood-lighting landing areas are based on the principle of a flat beam projected over the landing area from a light source elevated not more than 15 or 20 ft. above the surface of the ground. If the grades are not planned with night lighting in mind, shadow pools (which are confusing to the pilot), may result.

Adequate drainage is essential, but actually it is frequently subordinated to some more visible detail of the airport. If runways are to be installed and operations confined to them at least during wet periods, the drainage system need not be as elaborate as though turf areas had to handle the traffic. So called "surface intercepting" drains, which consist of a pipe laid in a trench back-filled with crushed stone, are of little use in northern latitudes in the Spring (when they are needed most) as they are likely to freeze. Positive openings in the form of manholes or catch basins that provide direct access for surface water to the system below the frost level are necessary.

French drains along the edges of runways leave much to be desired. Loose stone is kicked about over the runway and when the frost is in the ground the drains lose their effectiveness in handling surface water. In general the runways should be elevated above the rest of the landing area. The practice of placing a drain line under the center of an inverted crown runway with connecting catch basins and elevating the adjacent turf areas is not favorably regarded, as soft shoulders result together with silt over the runway and a likely skim of ice during the winter.

Runways

Eventually the airport without improved surfaces will be as obsolete as the corduroy road. Not so long ago the cry was for a "resilient" surface which turf seemed best to provide, but this resiliency proved negligible and with the advent of brakes and the tail wheel the last objections to hard surface runways have been dispelled.

The airport runways should be designed to support the loads that may be expected during the life of the pavement. An extensive investigation among designers of airplanes seems to indicate that the land air transport of the future may have a gross weight of 30,000 to 40,000 pounds with an unsprung weight of approximately 4% of the sprung weight. It is anticipated that the new transport airplane will be a refined and more efficient version of the present equipment, that landing speeds will be held to something like 65 miles an hour and take-off runs to 1000 ft. It is expected that the ratio between cruising speeds and landing speeds will be better because of improvements in engines, planes, and accessories but it is not expected that the designers will apply any advantages (such as flaps) to materially reduce the 65 mile an hour landing speed permitted by the Department of Commerce. As refinements are developed designers will further clean up the design of aircraft and increase wing loadings.

There is no very definite data as to the relation of dynamic to static loads. From the best information available, however, it seems that the total impact (the sum of the static and dynamic loads) of an airplane in landing is anywhere from 1.5 to 2.5 times the static load, but in the case of a bad landing this percentage may be somewhat higher. It is felt that a runway comparable in strength to the improved highway will support any type of aircraft we are liable to see during the life of that runway.

Runways vary from the simple gravel or cinder strip, to the high stage Portland cement concrete or bituminous concrete, or macadam types of construction comparable to the finest highways. One of the greatest needs in runway construction is for a workable plan of progressive or stage construction that will give the smaller airports (or the airport without ample funds) an improved surface to operate on in the Spring when the frost is coming out of the ground, and a surface which can be incorporated in more durable material as funds become available.

The following plan which seems to have very definite advantages has been suggested. This plan contemplates the establishment, at the outset, of the position, width, and length of runways. Gradients would be calculated so as to elevate the runway areas above the surrounding field. The top soil would be stripped and a sub-base of some suitable material placed along the course of the runway after which the top soil is replaced. The lines of the runway would be marked with inexpensive white strips to indicate to the pilot the areas that he can count on as being drier and more suitable during wet weather. The scheme has these advantages; surface water will be taken away from the runway areas, ground water will be better controlled, a more stable surface is provided, and as a community obtains additional funds the sub-base can be incorporated into the highway.

In a number of instances a local aggregate such as gravel, shell, crushed stone, etc., has been rolled into the soil to stabilize it. This is undoubtedly of assistance but experience has demonstrated that this treatment does not appreciably improve the permeability of the soil.

Runways providing 4-way landings and take-offs are found at a number of ports. Three runways or sets of runways providing six-way operation are less frequent, and eight-way facilities are comparatively rare. For 24-hour use by transport aircraft, runways should be at least 3000 ft. long with clear approaches and they should be 150 ft. wide. In snow country, particularly, the 150, ft. width is essential to maintain an adequate width clear of snow.

(*Continued on page* 102)

A new WORLD'S RECORD
230 MILES *per* HOUR
established by the
SEVERSKY CYCLONE AMPHIBIAN

A Wright Cyclone 730 h.p. Engine powered Major Alexander P. de Seversky's Amphibian in which he recently established a new world's speed record for amphibian planes of 230.03 miles per hour.

This record-smashing flight exceeded by 39 miles per hour the previous world's record of 191 m.p.h., established in a Cyclone-powered, service type Coast Guard Grumman Amphibian.

Major de Seversky's fastest lap was negotiated at a speed of 235.96 miles per hour. Upon completion of the flight, he wired, "Cannot praise too highly the excellent performance of the Wright Cyclone Engine. It functioned faultlessly throughout the entire trial and with remarkable smoothness, due to the new Wright Dynamic Damper."

Wright Cyclone Engines power the majority of the latest types of high-speed transports now in operation on leading airlines of the United States and throughout the world—*a tribute to their dependable performance.* Cyclones also power many of the latest and swiftest types of United States military aircraft.

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Control tower showing operations officer directing traffic at the Wayne County Airport, Michigan

AVIATION RADIO COMMUNICATIONS

ALBERT E. BRUNDAGE

Aeronautical Radio Specialist
Western Electric Co.

● Radio communication has been recognized by air transport lines as an almost indispensable adjunct to their operations. It is only recently, however, that private pilots (so called itinerant flyers) have realized its value and equipped themselves, in ever increasing numbers, with radio transmitting and receiving apparatus. Today the stage has been reached where every airport manager, sensitive to the demand on the part of his flying patrons for adequate airport radio facilities must (if he has not already done so) add to his own knowledge at least some understanding of radio systems as applied to the aviation industry.

The story of radio in air transport operations is too well-known to require more than a general outline and this article will serve as a background to enable the airport manager more readily to understand its operation in the service of the itinerant flyer.

Today, every transport plane of the major airlines in the United States is equipped with two-way radio telephone facilities. Contrary to general usage in other fields of endeavor, two-way facilities in aircraft do not mean just a transmitter and a receiver, but a transmitter and *two* receivers. Furthermore the Federal Communications Commission has assigned each airline its own radio frequency channel for inter-communication between its planes and its ground stations. These frequency assignments are all in the short wave band—between (roughly) 3,000 and 6,000 kilocycles, or 100 to 50 meters. (Dividing kilocycles into 300,000 gives meters, and vice-versa).

Above the short-wave band, between 200 and 600 meters (1,500 to 500 kilocycles) lies the broadcast band within which we, with our home radio sets, get our favorite programs.

Above this broadcast band, again, lies a broad band which has been allocated by the Federal Communications Commission to many other services, and it is in this long-wave band that we find the facilities provided by the Department of Commerce for beacon flying and for keeping a pilot informed as to weather conditions at all points along the airways.

Albert E. Brundage

This, then, explains why air transport lines provide two receivers in their ships—one receiver (short-wave) for intercommunication between their pilots and ground stations, each transport line on its own short-wave frequency, and one (long-wave) for the reception of beacon signals and weather information from the Department of Commerce long-wave stations. The use of one receiver for both purposes would obviously be impossible, due to the fact that reception on both wave-bands (inter-company messages, and Department of Commerce beacon signals or weather reports) must often be carried on simultaneously.

Air transport radio equipment, then, consists essentially of a transmitter and two receivers, although some ships also carry a dual-wave stand-by receiver for emergency use. The transmitter as generally used by the airlines is a radio telephone transmitter of 50 watts carrier power, capable of substantially complete modulation, and (because of the paramount necessity for dependable operation) with its frequency output controlled by a low-temperature-coefficient, quartz-crystal oscillator which maintains its frequency to within 0.025 of 1%. Similarly crystal-controlled receivers, both on planes and at ground stations, assure that there need be no twirling of the dials, no fishing, in order to insure tuning in on plane-to-ground or ground-to-plane messages.

The effective all-weather range of these transmitters being in the neighborhood of 100 miles, the air transport lines by establishing ground stations at points approximately every 200 miles along their routes are able to keep in constant touch with their pilots at all times, receiving from them periodic reports of their position and the weather conditions under which they are flying, and giving to the pilots, in turn, information as to conditions ahead, and instructions as to their future procedure. The employment of radio telephone, which is almost universally used in preference to radio telegraph, obviates the necessity for training pilots in code transmission or reception, or for carrying extra trained radio telegraph operators.

Reference has already been made to the fact that each air transport line operates on its own assigned frequency. There is somewhat more to it, however. Experience has demonstrated that a frequency which is fully satisfactory for operations during daylight hours is, due to atmospheric conditions and other technical reasons, unsatisfactory for service at night. The result has been that two frequencies have been assigned to each airline, one in the neighborhood of 5,000 to 6,000 kilocycles for day, and one around 3,000 to 3,500 kilocycles for night. The change-over from day to night operation usually occurs at about twilight and from night to day at about dawn. This varies with each airline, but occurs for each at a definite hour. Since any of the airline's ships may be in the air at that particular hour, provision has had to be made so that the pilot can, without undue effort change his transmitter from day-frequency to night-frequency operation, and vice-versa. Each transmitter, therefore, is equipped with two crystals and two sets of fixed coils, enabling the pilot, usually by throwing a lever in the cockpit, to change his operating wave-length.

Besides the two channels for day and night operation, a third channel is provided on the latest type of transmitter. By means of this the pilot may, if he desires, change to 3,105 kilocycles for contact with radio equipped airports and Department of Commerce stations along his route.

The need for changing from day to night operating frequency while in flight is of course not confined to the transmitter alone. The short-wave receiver for inter-company communications must also be capable of the quick-shift change-over. Here again this is accomplished by a fixed tuning arrangement, and by the use of quartz crystals ground to oscillate only at definite predetermined frequencies.

The receiver generally used by the airlines is of the superheterodyne type, employing eight tubes and a ballast lamp with the quartz crystal controlling the beating oscillator, and having a high degree of sensitivity and selectivity. The latter is such that the signal is down approximately 60 db at 10 kc off frequency. This receiver also has an automatic volume control feature to insure quiet operation, an increase in strength of the incoming signal from 10 to 10,000 microvolts only causing a 6 db increase in audio output. Headset reception is employed.

Aircraft Radio Equipment

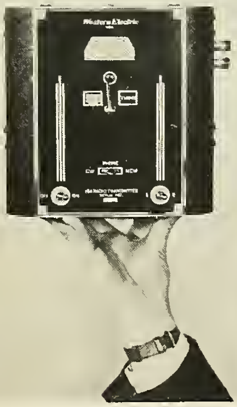
The long-wave, or beacon receiver, in general use is also of the superheterdoyne type, having one stage of tuned radio frequency, an oscillator, modulator, two stages of intermediate frequency amplification, detector and two stages of audio amplification. It has a frequency range of from 200 to 400 kilocycles but unlike the short-wave receiver is not crystal controlled. The reason for this is that all Department of Commerce beacon and weather stations throughout the country (with widely distant exceptions) operate on different frequencies, and a pilot may on one flight have to tune his receiver to any number of stations.

Crystal-controlled radio transmitter for directing traffic at airports

All this equipment, both transmitting and receiving, is so designed that it can be installed in some out-of-the-way corner of the fuselage or baggage compartment, and be remotely controlled from the cockpit.

Plate power is provided by dynamotors operating off the airplane's 12-volt bat-

Double duty receiver installed in a Fairchild



11-pound radio transmitter

Two-way equipment for the private-owner pilot tery which also lights the tube filaments. Two dynamotors are used, one furnishing 1,050 volts for the transmitter the other supplying about 250 volts for the receivers.

It is not to be understood that all radio installations in the air transport liners are identical. Various types of transmitters and receivers are in use, depending upon what was in vogue at the time when the installation was made. The above, however, is representative of a typical installation on a modern ship.

Ground Station Equipment

Ground station installations also differ. In general, however, they consist of a telephone transmitter of 400 watts power, crystal controlled, capable of substantially complete modulation and arranged for quick-shift from day to night frequency and vice-versa, together with a highly-selective receiver, usually of the superheterodyne type, and in many cases, also crystal controlled. In localities where there is apt to be considerable "man-made" static interference at the airport, the modern practice is to locate this receiver at a quiet point, often several miles away. Its operation in that case is controlled entirely at the airport through a dialing mechanism which sends pulses over a wire line circuit. This telephone circuit also serves to transmit the receiver output to the airport ground station, where it is amplified and fed into a loud speaker. Transmission both at the ground station and in the planes is usually effected by a push-button or key on the microphone which, when pressed, operates a relay that connects plate power to the tubes and puts the transmitter on the air.

Some of the most recent ground station installations use a newly-developed transmitter having provision for ten frequency channels, each crystal controlled. The desired channel is selected by dialing one digit in a standard telephone dial, which operates a miniature "machine switching" selector mechanism such as is found in dial-telephone central offices.

What has been done by the air transport lines in providing radio communications must be done by municipal and commercial airports, if the airports are to meet the rapidly increasing demands of hundreds of flyers who have equipped their ships with up-to-date radio facilities.

E. L. Saunders, EAL radio operator at Newark Airport, typing a message for Fred A. Jones, EAL pilot. The transmitters are housed in the cabinets in the background

The modern airport can no longer perform its function with a few lights and a wind sock. It has already learned the need for an adequate public address system for announcing incoming and outgoing ships, for paging purposes, and innumerable other uses. Now it must, if it is so continue to be up-to-date, add radio transmitting and receiving equipment to its service facilities. This equipment need not be elaborate, nor need it be costly.

Meeting Private Pilot Needs

There is available a small radio transmitter specially designed for airport use and conforming to the limits of 15 watts specified by the Federal Communications Commission that has more than ample range for such service. Transmitters of this type are in use all over the country, major airports like Newark, Chicago, Oakland, Denver, San Francisco and Burbank, being included in the list. This transmitter, which is ac operated, crystal-controlled, and capable of full modulation, has all the features demanded for such service. It, together with a full set of vacuum tubes, a quartz crystal ground to 278 kilocycles (the national airport frequency) and a desk-stand type microphone, can be obtained for somewhat under $750 complete. Its installation is simple, and can be completed by any competent mechanic in a few hours.

Receiving equipment is of course available for prices anywhere from a few dollars up. It should be borne in mind, however, that once this service is begun, its absolute *dependability* must be assured. The safety of fliers who look to a particular airport for such service may hinge upon the certainty that the airport will hear their calls. For a few hundred dollars an airport can obtain the best type of superheterodyne receiver having high sensitivity, automatic volume control giving quiet operation, and crystal control assuring that it will always be accurately tuned to receive all messages sent to it from ships desiring to communicate.

Airport Transmitters

To be of value, operations must be on a 24-hour basis. Constant watch should be maintained on the 3,105 kc. "national calling" frequency for the reception of messages from approaching fliers. Operators on duty need not be highly trained radio men. Modern equipment is so designed as to require very little adjustment or maintenance. Federal regulations demand that operators of radio transmitters be licensed but this need not be a deterring factor, since only a third-class radio telephone license is required to operate transmitters of less than 50 watts power.

No knowledge of code is necessary, only a general understanding of the equipment to be operated and a knowledge of the Federal rules and regulations governing radio transmission. A few hours study by a person of average intelligence will enable him to pass the examination for a third-class license which incidentally is held by every pilot on radio-equipped air transport liners.

The radio equipment required for the average airport is far from extensive. Airports which are regular ports of call for air transport lines will, if they desire to handle their traffic adequately, want to add a receiver for each of the airlines coming into their field. At Newark Airport, for instance, five receivers are provided in the control tower, one for each of the four airlines using the field as a terminus, and one for the reception of messages from itinerant flyers. At most airports, however, the provision of a transmitter and a 3,105 kc. receiver will be sufficient.

Present Radio Facilities

With these facilities, the airport will not only enormously increase the value of its services to its patrons, but will be in position to take advantage of that most effective of all means of airport traffic control—radio. The time is undoubtedly coming when airports will be so congested that traffic control by means of lights and signals will be impossible, and when every flyer will be required, for his own protection and that of others, to provide at least a radio receiver on his ship.

Today a private flyer can for about $200 provide himself with the most modern receiving equipment, consisting of a receiver, complete vacuum tubes, an anti-static damped diaphragm head set, and a dynamotor for power supply. This receiver, which is compact, light-weight, and efficient, operates on two frequency bands, one from 190 to 450 kilocycles for reception of Department of Commerce beacon signals and weather reports, and the other, from 500 to 1,500 kilocycles, the "broadcast" band. A flip of a switch changes from one band to the other and a calibrated dial makes tuning simple.

Transmitting equipment is also available to the private flyer, an extremely compact unit which (complete with tubes) weighs about 11 pounds, having recently been developed by Bell Telephone Laboratories. Although it employs only two tubes and is so small that it can be held in one hand, this transmitter is unusually efficient. It also has crystal control and operates on one or two predetermined frequencies, as desired Where a pilot desires to operate on 3,105 kc. (the national calling frequency) and on 3,120 kc. (the national working frequency) transition from one to the other is accomplished by throwing a key No retuning is necessary. This transmitter also provides for three types of operation, phone, CW or MCW, conversion from one to the other being accomplished by merely throwing a switch.

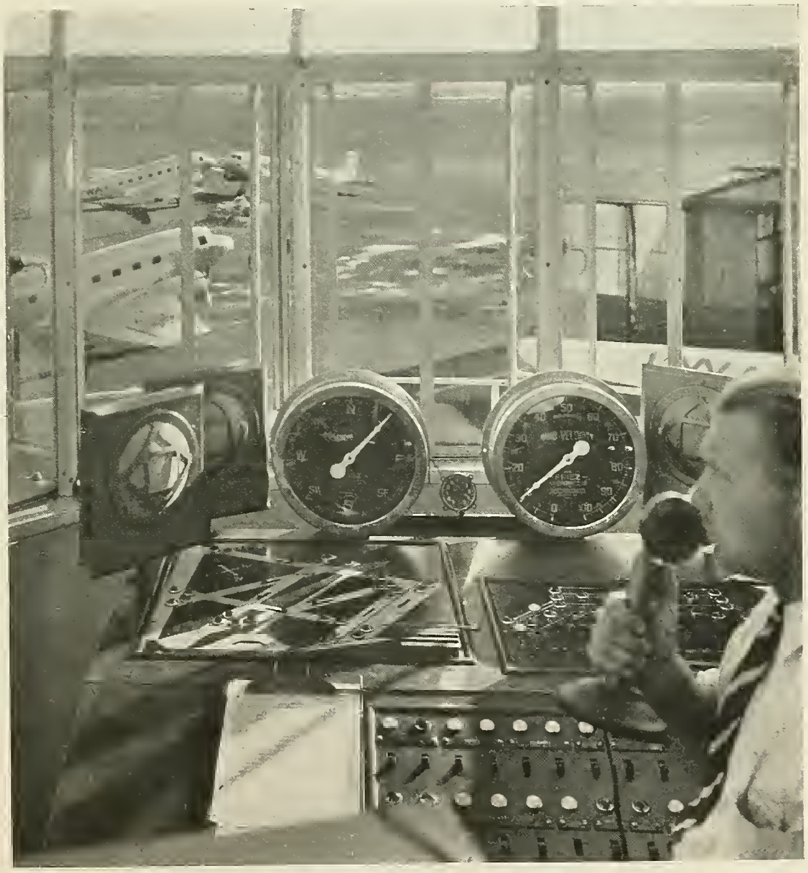
Radio science has provided every facility not only for air transport but for the private flyer and for the airport. The Federal Government, with its extensive network of Department of Commerce stations giving 24 hour service, has done its part, stimulating private flyers everywhere to equip themselves to take advantage of that service. It is now up to the airports to round out the scheme, and to provide for these flyers adequate airport-communications facilities.

That this demand will be met no one who has observed the rapid adoption of radio by the airlines can question. It is less than 10 years ago that radio conversation between a man in a plane and a man on the ground was first publicly demonstrated. Today millions of Americans—air travelers who have watched it, movie goers who have seen it on the screen, or others who have read about it —are familiar with the picture of a pilot raising a microphone to his lips and thus summoning to his service thousands of eyes watchful of his welfare and the welfare of his passengers.

Within a short time of that first aerial conversation, the most progressive airlines were equipping themselves with radio. They recognized almost at once what it would mean in safety and efficiency and in overcoming weather hazards.

The private flyer is no less interested in his own safety than is the transport company in the safety of its patrons. The example set by the airlines is an irresistible one; he will do likewise, particularly in view of the fact that equipment performing the same service, designed and produced on the same high standards and yet scaled to the smaller size of his plane, is available.

Radio equipment on a plane, without the complementary equipment on the ground, however, is as useless as a home receiving set without any broadcasting stations or a telephone without a central office. On the one hand, the installation of adequate radio facilities at airports will encourage the itinerant flyer to equip his plane; on the other, the radio-equipped private flyer will tend to favor those airports which can give him radio service, thus stimulating other airports to meet this competition by equipping themselves. The development on both sides will go hand in hand.



W. J. Conrad is directing take-offs and landings by radio at Newark. On the desk are the field lighting controls, two wind indicators, and loudspeakers

DEVELOPMENT OF AIRWAY BEACONS

H. C. RITCHIE

General Electric Company

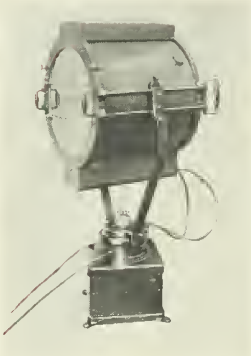


Fig. 1: Eighteen-inch revolving beacon used by the Post Office Department on first lighted airways

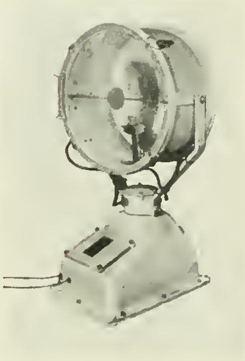


Fig. 2: First design of 24-inch beacon used on Post Office Department airways

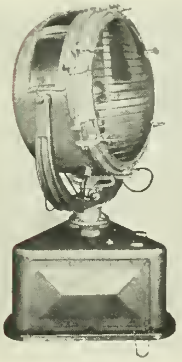


Fig. 3: The 24-inch beacon designed by Airways Division for use on Department of Commerce airways

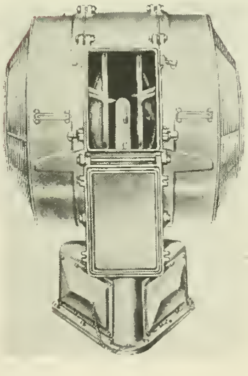


Fig. 4: A 36-inch double-end airway beacon (Photo courtesy of Crouse Hinds Company)

● Were airplanes restricted solely to daylight operations, their acceptance as a transport medium would be seriously handicapped. The remarkable air transport system in this country has largely been built up upon its ability to operate in practically any weather, during the day and at night. Efficiency in adhering to schedules has increased, so that an interrupted or cancelled flight is the exception, rather than the rule. Private flying also has become more practical and dependable because of the aid provided by the Federal Airways System which today embraces more than 20,000 miles of lighted and radio-equipped routes.

When the first beacons were installed on the Post Office Department airway between Chicago and Omaha, several experimental types were used, including a 36-inch high intensity arc revolving searchlight with a candlepower of about 350,000,000; an 18-inch revolving incandescent searchlights of about 900,000 candlepower (figure 1) ; and gas blinkers.

The 36-inch beacons were placed at terminal fields, the 18-inch beacons about 10 miles apart along the airway, and the gas blinkers were used in locations where power supply was not available.

The 18-inch beacons were found not large enough and the next beacons designed were 24-inch in diameter (figure 2). These used the 1000 watt, 115 v. lamp which is still the airway standard. The use of the 36-inch arc beacons was abandoned on account of the operating expense, although a few airports still use them in exceptionally bad weather.

Use of the gas blinkers was finally discontinued because they did not assist the pilot when he was to one side or the other of the airway.

The 24-inch beacon was of the projector type using a glass parabolic mirrow with plane front door glass. This beacon projected a single beam a few degrees wide and was revolved at 6 r.p.m., giving a flash every 10 seconds. It was effective at a distance but was difficult to locate from overhead. To meet this objection zenith light panels were added to the top of the drum to give direct light upward and a special upward deflecting front door glass was designed to project about 20% of the beam at an angle upward of about 25° (figure 3).

To insure reliability of operation, the later 24-inch beacons were equipped with automatic lamp changers which put a spare lamp into the circuit and in proper position upon failure of the first lamp.

To further increase visibility of the beacon, the Bureau of Air Commerce designed a 36-inch diameter, double end, lens type of beacon which increased the duration of flash by cutting the speed in half, or to 3 r.p.m. (figure 4). This beacon, however, was not capable of being adjusted for elevation of beam, except through small angles. Neither did it approach the ideal condition of continuous visibility, which would enable the pilot to keep his attention fixed on the beacon location.

To meet certain weather conditions

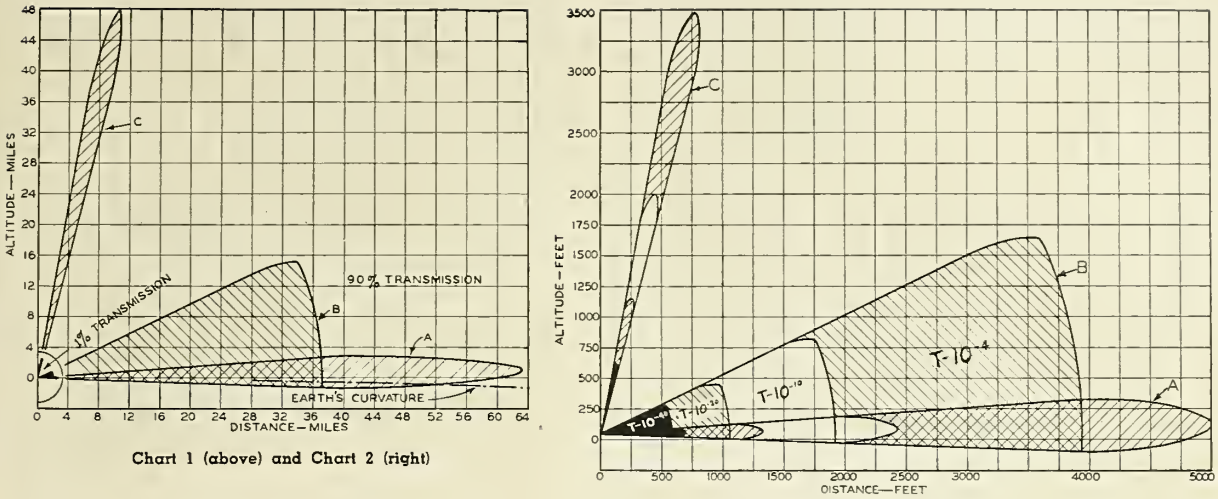


Chart 1 (above) and Chart 2 (right)

prevalent in the Rocky Mountains, the Bureau of Air Commerce purchased a number of beacons of General Electric design. The moving parts of these were enclosed in a glass dome (figure 5), thus preventing freezing under extreme snow and ice conditions. Because of limitations in glass dome manufacture, the mirror was only 20 inches in diameter. It gave visibility for 180° of rotation but was still not ideal from this standpoint.

In Europe, the flashing beacons (figure 6) being used gave visibility from the horizontal to the zenith and through 360° in azimuth, but were necessarily of low candlepower, requiring closer spacing and were not as effective off course as the projector type.

In 1931, John B. Bartow was granted a patent on a new type of beacon which combines the advantages of high candlepower of the projector type with the wide angle visibility of the flashing type and by its symmetrical form prevents uneven pressure from high winds and is not so liable to be frozen up in extremely bad weather.

It is a 36-inch beacon (figure 7) and is being manufactured by General Electric, under license from Bartow Beacons, Inc.

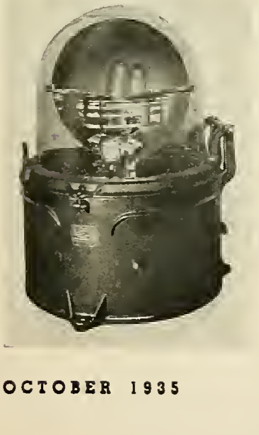


Figure 5. A 20-inch glass-dome beacon used by Department of Commerce at locations in the Rocky Mountains

Some of the advantages, in brief, of this beacon are: continuous, and wide vertical range visibility; long duration of flash; vertical beam acts as ceiling height indicator from the ground or from above; renders unnecessary the use of code beacons at airports or course lights on the airways; easily identified and readily distinguished from surrounding lights by its distinctive characteristics; the effect of dimming between flashes makes it distinctive and easier to follow; the continuous visibility prevents eye strain by permitting the eye to retain the point of light and remain in focus; main beam can be elevated without loss of candlepower; operation steady, unaffected by high winds, due to its symmetrical surface; motion in vertical beam attracts attention when main beam is not visible; and at airports, it illuminates the surrounding area to show the approaching pilot the character of the surface of the ground.

The Bartow Beacon

This new beacon utilizes three lens systems (figure 8): (a) A doublet lens combination which produces a high candlepower beam *A* concentrated to a small angle in both vertical and horizontal planes; (b) A cylindrical fresnel lens which produces a lower candlepower spread beam *B* of small vertical divergence but covering 270° horizontally; and (c) A top ceiling lens producing a concentrated beam *C*.

The main beam is projected horizontally or at a small angle of elevation and rotated at 6 r.p.m. The fresnel lens is tipped on the axis of rotation, producing a wobbling effect. The ceiling lens is also tipped at the same angle as the fresnel lens giving motion to the beam when the beacon is rotated.

On airways, the addition of green or red color screens inside this beacon will indicate "landing" or "no landing" locations and eliminate the use of course lights. At airports, a green color screen will indicate a landing place and the code beacon may be omitted, except when the airport is located near others from which it is necessary to distinguish it.

Referring to figure 7, the lens for the main beam (*A*) will be seen at the left of the side view. The center line of this beam is practically horizontal, although this setting is adjustable, and is made to suit the terrain when installing the beacon. This is done by loosening the four bolts holding the lower spherical casting to the saddle block and prying between bosses on the spherical casting and the edge of the saddle. The holding bolts are accessible through the large hand hole in the spherical casting, the cover of which is quickly removable.

Behind the outer lens is an inner doublet lens mounted on two of the tie rods which support the upper ring casting. This inner lens is mounted in a lens frame, the position of which is adjustable in all directions on the tie rods. This adjustment is made at the factory and need not be changed except upon replacement of the inner or outer lens.

By referring to the front view, figure 7, it will be seen that the cylindrical

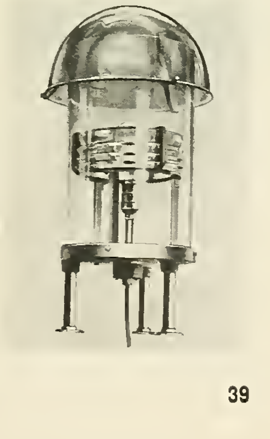


Figure 6. Incandescent-lamp type of flashing beacon (Photo courtesy of B.B.T. Corporation of America)

fresnel lens, extending for 270° around the beacon, is tipped at an angle to the horizontal. This lens is so designed that with a 12° tilt the lower side of the spread beam (*B*) is horizontal, while the upper or opposite side is elevated 24°.

In certain locations it may be found desirable to change the elevation of the cylindrical fresnel lens system, and this may be accomplished by reversing the position of the bottom spherical casting on the saddle plate.

The top or ceiling light lens is mounted in a separate ring which is readily removable from the beacon for assembly and for cleaning the inside of the lenses.

The automatic lamp changer is mounted vertically on the bottom spherical casting and remains in correct alignment with the lenses during all adjustments.

Relamping is accomplished through the hand hole in the bottom spherical casting. No adjustments of the lamp changer are required as the lamps are of the prefocused bi-post base type.

Charts 1 and 2 show the distribution of the three beams in each revolution of the beacon, relative to any vertical plane passing through the center of the beacon. Chart 1 shows the distance and elevation at which the different beams are visible, both when the atmosphere transmits 90% of the light per mile and when it transmits 1% (10^{-2}). Beam *A* is a highly concentrated beam similar to that of the old type of revolving beacon. At 90% transmission, beam *A*, along its center axis, which is the brightest part of the beam, can be picked up from a distance of 63 miles if the observer is at 10,560 ft. and if the center axis of the beam is set 1° above the horizontal. Under this condition, beam *A* reaches its maximum altitude at 41 miles distance and is 15,000 ft. high. Beam *B* is from the inclined-spread fresnel lens, and does not have as high candlepower as beam *A*, so that at 90% transmission, this beam can be picked up at a distance of only 37 miles. The maximum angle of beam *B* above horizontal is 27° so that the top of the beam reaches 15 miles elevation. Beam *C*, which is a revolving ceiling light, is visible 48 miles above the earth and would have little value during clear weather, except to an airplane flying in the stratosphere directly over the beacon when there are high scattered clouds.

At 1% transmission the distances and altitudes are greatly reduced as shown by the solid black area in the lower left-hand corner of Chart 1. The distance beam *A* can be picked up is then 2.8 miles with an altitude of 1000 ft. and beam *B* 2.1 miles with an altitude of 5000 ft.

Chart 2 is drawn to a larger scale to show the area in which the beams are visible when the transmission is cut down to the low values of 10^{-4}, 10^{-10}, 10^{-20}, and 10^{-40}, such as exist during light fogs, heavy fogs, heavy snowstorms, etc.

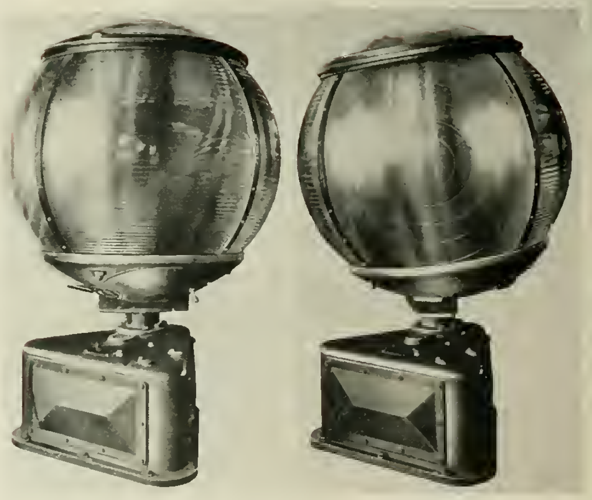


Figure 7. New General Electric 36-inch airport and airway beacon manufactured under license from Bartow Beacons, Inc. Side view at left; front view at right

When the transmission is 10^{-4} or during light fogs, beam *A* has a range of 5000 ft, with an altitude of 325 ft., and beam *B* would have a range of 3950 ft. with an altitude of 1650 ft. Beam *C* would be visible at 3400 ft. altitude directly over the beacon. When transmission is as low as 10^{-40}, which corresponds to heavy, dense fog or snowstorm, the penetration curves of the beacon are indicated by the solid black area with beam *A* having a range of 700 ft. and an altitude of 85 ft. and beam *B* a range of 585 ft. and altitude of 275 ft. Beam *C* would reach an altitude of 625 ft.

Chart 3 shows the duration of beams *A* and *B* relative to degrees of elevation from the beacon. Beam *A*, at its widest spread, at 1° of elevation, has 1/6 of a second duration of flash, when the beacon revolves at 6 r.p.m. At 2° elevation, it would have 5/36 of a second duration, and at 3° elevation, 1/9 of a second duration.

Beam *B* at both 1° and 22° elevation has a duration of $2\frac{8}{9}$ seconds. At 13° elevation, the shortest point of duration for beam *B*, it still has a duration of 26/36 second. During good weather, 1/6 second flash is sufficient, as in beam *A*, but in bad weather during poor transmission of light, longer durations at higher degrees of elevation, such as are provided by beam *B*, are necessary.

Comparing the three charts, it will be seen that in good weather beam *A* makes the most efficient beacon, but in bad weather has less value. Beam *C*, except for stratosphere flying, has little or no value in good weather, but in bad weather becomes of great value and, with beam *B*, furnishes the most important part of the beacon. Beam *B*, because of its long durations, permits the use of color screens to designate many different types of beacons. Also because of the difference in duration of flash between beams *A* and *B* and their spacing, they can be made to flash dot-dash or dash-dot, by changing the rotation of the beacon or the position of beacon head.

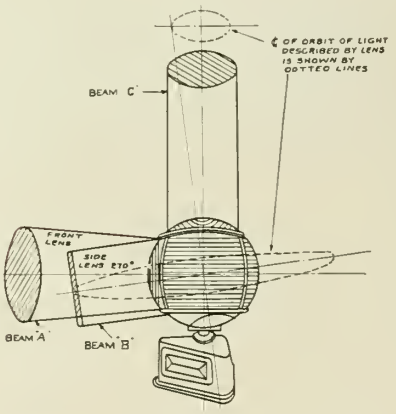

¢ OF ORBIT OF LIGHT DESCRIBED BY LENS IS SHOWN BY DOTTED LINES
BEAM C
FRONT LENS
SIDE LENS ETC.
BEAM A
BEAM B

Figure 8. Diagram showing effects produced by the three lens systems of 36-inch Bartow beacon

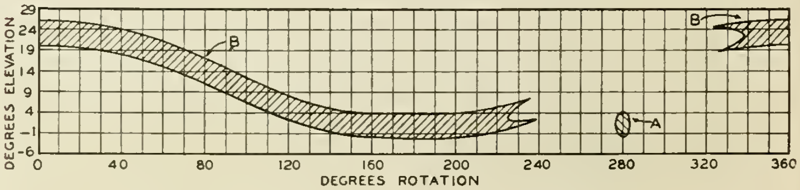


Chart 3. Beam durations. 1° rotation = $\frac{1}{36}$ sec. duration at 6 r.p.m.

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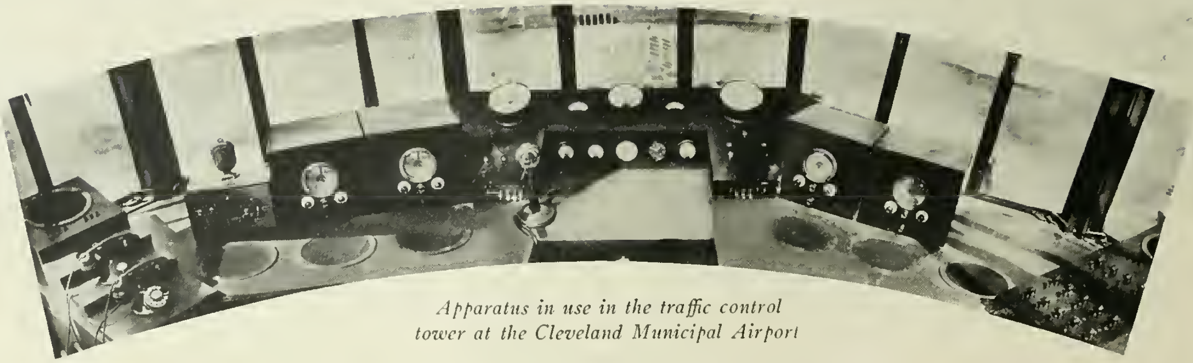


Apparatus in use in the traffic control tower at the Cleveland Municipal Airport

AIRPORT TRAFFIC CONTROL

DAVID S. LITTLE

Manager, Aviation Radio Sales
R.C.A. Manufacturing Company, Inc.

● The steady increase of flying through bad weather conditions has so amplified the problem of airport traffic control that means of positive control has become imperative, especially at larger fields, and those electing to employ runway operation.

At first, checkered and red and white flags were employed, largely to govern take-offs rather than landings. This mode of control was soon outgrown by the constantly increasing traffic, and various electric-light signalling methods were experimented with. Possibly the most valuable outcome of this period of traffic control development is the daylight signal lamp, which has survived and is still in use at some airports. Lights and flags, however, could not answer the problem of controlling the approach of inbound aircraft and the departure of outbound aircraft beyond visual range.

As radio began to be adapted to the many needs of aviation communication and control, consideration was directed at the employment of low-power radio telephone transmitter equipment to direct, by radio telephonic communication, the take-offs, departures, approaches and landings of radio-equipped craft. This development covered a period of several years, during which some haphazard radio equipment, operated by inexperienced personnel, gradually developed into the modern airport radio traffic control.

Today's modern airport includes an administration building, from which usually all scheduled aircraft are dispatched. This building includes a control tower usually situated atop this building and so arranged and located as to offer unobstructed vision of the complete airport and all of its approaches. This tower is equipped with a single-unit airport transmitter, capable of operating from 110-volt alternating-current power supply and delivering 15 watts of radio frequency energy on 278 kilocycles (1080 meters), which is modulated by conventional microphone and voice amplifier units included in the transmitter frame. The tower also includes one or more AC-operated receiver equipments—usually one receiver equipment for each airline operating from the particular airport, plus one additional receiver for operation on the international standby frequency of 3105 kilocycles, on which all private and itinerant aircraft radio stations operate. The tower usually also includes complete control mechanism of the airport lighting system, including floodlights, as well as a microphone connected to the administration building speech amplifier system, so that the control personnel may announce arrivals of inbound scheduled aircraft. In the more advanced setups the tower may also include controls of a "runway localizer" which, briefly, is a miniature radiobeacon. This consists of the airport traffic control transmitter, operated through an accessory assembly as a radiobeacon when it is not being otherwise used for telephonic traffic communication, or may include a separate low-power radiobeacon transmitter. This transmitter apparatus, with the exception of the control mechanism which is located in the tower, is so located on or about the airport that one of the on-course signal zones of the radiobeacon is transmitted across the longest, clearest approach of the particular airport with regard to prevailing wind direction. It is probable that the last-mentioned apparatus will undergo considerable expansion in the near future because of the increasing need for means of landing aircraft safely during periods of low or zero visibility. This expansion will possibly see the addition of "marker" transmitters of very low power, perhaps operating on ultra-high frequencies, used in conjunction with the runway localizer to more clearly outline the required dimensions of a low-ceiling approach to the particular airport. It is possible, too, that this expansion may include radio apparatus and radio means of determining the most satisfactory glide angle to the airport's "radio approach."

Practically all of the larger airports of the United States now have airport radio traffic-control apparatus and employ this system of traffic control. The growth of airline traffic as well as itinerant traffic has proven the value of the control station many times over. There is no doubt but that all airports will eventually use this means of control and the day will doubtless come when all aircraft are required to carry at least a simple aircraft radiobeacon-weather receiver. Without effective radio traffic control, the busy airport will find it increasingly difficult to cope with the hazards presented.

Utilization of the Radio

The foresight of the Federal Communications Commission brought allocation of the frequency of 278 kilocycles for use of airport traffic-control systems. This particular frequency, falling as it does in the band of 200 to 410 kilocycles, in which band are located all radiobeacons and weather-voice-transmission stations of the U. S. Bureau of Air Commerce, permits any aircraft equipped with a conventional radiobeacon-weather receiver to take advantage of the traffic control facilities of any airport so equipped. No additional apparatus is required. An inbound aircraft employing only a radiobeacon-weather receiver can make the customary approach to an airport by the established Bureau of Air Commerce radiobeacon, assisted by weather information transmitted by the same station. Upon approaching an airport equipped for airport radio-traffic control, the pilot tunes his radiobeacon-weather receiver from the particular radiobeacon weather station he may be operating on, to the frequency of 278 kilocycles. The airport traffic control officer upon hearing radio calls from, or upon sighting any inbound craft, places his traffic control transmitter in operation and broadcasts a reply or call to this craft. Should the plane not have two-way radio communication and, therefore, unable to reply to such signals, it is customary to visually acknowledge receipt of this first call merely by wiggling of wings or dipping of nose. The traffic officer, upon obtaining either radio or visual acknowledgment of receipt of his calls, then advises the listening pilot of wind direction and velocity on the surface at that particular airport, the Kollsman barometer reading corrected to the surface, the ceiling in feet, the visibility in miles and a general summary of traffic on and around the field.

The pilot, upon receiving this information, acknowledges by radio or visual means, and the traffic control officer proceeds to direct the landing of the aircraft. On large airports in particular, this service is extremely valuable, for it permits the traffic officer to bring an aircraft directly into a desired landing area without interference with student aircraft, transport movements, etc. The phraseology and procedure employed naturally varies with equipment of the aircraft. If the aircraft is equipped with two-way radio apparatus and consequently calls the airport fifteen or thirty minutes out—in other words, before the aircraft is visible to the control officer—the phraseology includes more detailed instructions than would otherwise be used. The conventional phraseology covering operation with a two-way radio-equipped aircraft is as follows :

Pilot: (Should call tower approximately ten minutes out of airport)—"Smith in United Air Lines 111 to WRDT—Over Elyria at 2000. Go ahead."

Control Tower: "WRDT to Smith United Air Lines 111—over Elyria at 2000—there is one Pennsylvania Boeing just leaving the west side of the field flying at 1000 feet bound for Detroit; there is also one ship approaching the port just five miles southeast."

Control Tower: "Wind—northwest nine."

Control Tower: "Barometer 29.75."

Control Tower: "Ceiling 5000 feet."

Control Tower: "Visibility — three miles."

Control Tower: "There is one student ship flying around the field—it is now just over the southwest corner of the field. Nothing on the field at the present time."

Pilot: "OK—WRDT—Wind northwest nine" (Velocity in miles).

Control Tower: "WRDT to Smith in United Air Lines 111—That ship from the southeast is just landing and taxiing toward the hangar line, leaving the field clear."

Control Tower: "OK Smith in United Air Lines 111—I can see your ship southwest of the field—there is nothing around that section to bother you; that small student ship is several miles south of the field and not approaching at the present time. OK to come straight into a northwest wind for your landing; use east portion of field (or runway)."

(After ship has landed and almost stopped rolling.)

Control Tower: "OK Smith to turn right; small student ship landing to your left; taxi on to gate Number One."

Aircraft taking off from this airport and equipped with radio receiver equipment are expected to be governed entirely by radio instructions. The procedure for take-off is illustrated by the following general phraseology:

Pilot: "Smith—United Air Lines 111 at Gate five to WRDT—trip 14 eastbound; I expect to fly at 10,000—go ahead." (If pilot changes altitude, station gets this information during contact.)

Control Tower: "WRDT to Smith 111—time, just coming up 12:32½ (correct standard time); Barometer 29.86."

Pilot: "OK, WRDT."

(When Pilot is given clearance by ground dispatcher)—

Control Tower: "WRDT to Smith 111—OK to taxi south and prepare for take-off into northwest wind, nine miles per hour; one ship approaching for landing just over south boundary of field; will not bother you as he is using west portion of field."

(When it is seen that ship has warmed motors and is ready for take-off)—

Control Tower: "Clear behind you, Smith 111. Field clear—OK for your take-off." (Pilot must not take off without this OK; call tower if not received.)

(As soon as ship is well in the air.)

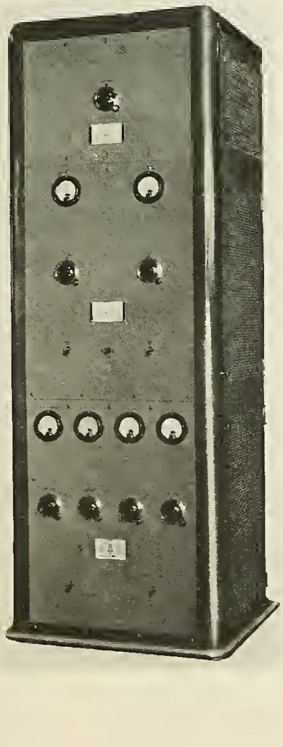
Control Tower: "Nothing north or east of you, Smith 111. OK to turn right. One ship reported on your course over Warren, westbound at 3,000."

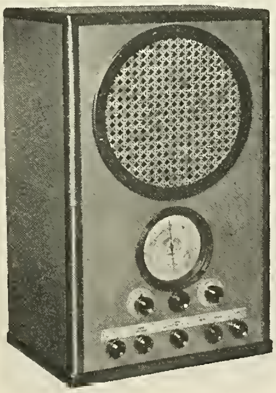
Pilot: "OK, WRDT."

(Ships not equipped to acknowledge by radio, acknowledge by rudder or aileron movement.)

It will be appreciated that the greatest value of airport radio traffic control is de-

Left—RCA airport radio traffic control transmitter. Right—Transmitter, amplifier and radiobeacon attachment in one unit





RCA Model AVR-5R, an airport receiver which covers the radiobeacon, weather, airline, itinerant, and entertainment broadcast bands

rived by the aircraft equipped for two-way communication, that is, a ship carrying a radio transmitter in addition to a conventional radiobeacon-weather receiver. To such aircraft it is possible to offer communication considerably in advance of arrival or departure and consequently give much more valuable information and assistance. For example, in these days of instrument and "over the top" flight, it is standard practice for airports having a low ceiling condition, to communicate with all known inbound aircraft sufficiently in advance to establish safest flight levels for their approach line of flight. Six transport aircraft flying on radiobeacon may be converging on a given airport from two or more directions, all flying on instruments or above an overcast. The traffic officer, knowing the movement of these aircraft and their position quite accurately—from continual listening to their two-way communication with their own or U. S. Bureau of Air Commerce ground communication systems—upon first establishing communication with each aircraft, designates an order of approach and landing, and if instrument flight is involved designates an altitude which each ship must maintain when within a reasonable distance of this airport, until given specific instructions to break through for a landing. Because of the greatly increased scheduled flight on instruments and above overcasts, this method of reducing or eliminating collision has become increasingly popular.

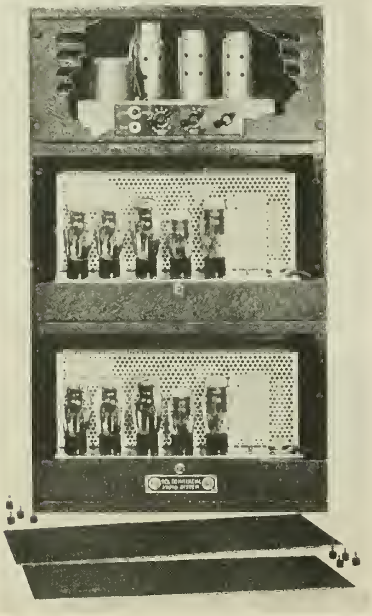
Outdoor directional baffle loudspeaker

Aircraft approaching an airport equipped with a runway localizer as well as telephonic traffic-control apparatus, under conditions of low visibility, may make good use of the runway localizers so provided through knowledge of location and courses of these localizers from reference to existing charts. For example, at Cleveland, an aircraft may approach on the regular Bureau of Air Commerce radiobeacon-weather station WWO, either on instruments or on top, and after locating this radiobeacon by its "silent zone" can then, through communication with the WRDT traffic control radio station, request operation of the field localizer. The aircraft receiver equipment can then be tuned to 278 kilocycles and left at this adjustment until the landing is completed, the aircraft being swung until the desired approach on the runway localizer is established, after which this course can be followed to a safe landing with the benefit of alternate voice transmission from the traffic officer in the control tower.

Operator's Requirements

This radio traffic control requires personnel of special qualifications, and airports using this type of control almost universally employ pilot personnel of mature judgment as traffic officers. These men have learned through personal experience the idiosyncrasies of this mode of operation and universally have gained such respect and faith of pilot personnel that their instructions by radio are unhesitatingly accepted and implicity followed. These traffic officers realize that they need make only one mistake to lose the confidence of pilot personnel, which it has taken them years to build. They are, consequently, a group of most cautious, far-sighted and thinking men.

Regulations of the Federal Communications Commission permit any airport to take advantage of radio in connection with the traffic-control problem. The airport need provide only a simple voice transmitter of 15 watts output, capable of operating on 278 kilocycles, and sufficient simple, inexpensive receivers to provide the required reception of airline and itinerant radio-equipped aircraft.


Arrangement of RCA Sound System

The evolution of airport traffic-control radio apparatus which has taken place over the past eight to ten years provides today a type of equipment which is thoroughly satisfactory and absolutely reliable. There are, of course, characteristics which must be considered in the purchase of this equipment, just as in field lights, runway materials, etc. These points are hereafter presented in the hope that they will assist airport management or owners in obtaining that type of equipment which will be most economical as regards first cost, operation and obsolescense.

The existing governmental regulations permit an output of only 15 watts on 278 kilocycles for this service. This low power has been, and will undoubtedly continue to be, necessary to prevent interference between nearby airports. However, this low-power transmitter cannot cover many more miles than is absolutely necessary to insure sufficiently early communication with arriving ships to do much good from a traffic control angle with the present-day speeds of aircraft. It follows that it is desirable to employ transmitter apparatus capable of providing the maximum permissible range, and therein lies a joker. In radio parlance, 278 kilocycles (1080 meters) is long-wave, and the most economically practical radio station to operate on this particular frequency would employ an antenna of approximately 100 to 150 ft. high and 200 to 300 ft. long. Such an antenna is obviously a hazard on or close to an airport. It follows that to obtain the maximum permissible communication range from an average single-wire airport antenna of approximately 30 ft. high, and 200 to 300 ft. long, it is necessary to compensate for the loss of antenna efficiency by power built into the transmitter. To obtain 15 watts of energy into the average inefficient airport antenna requires a transmitter unit capable of delivering 35 to 50 watts of power into an optimum antenna. Such a transmitter properly installed with the average antenna will deliver just about 15 watts of power and this can be regulated to the exact permissible amount and consequently provide maximum permissible range.

Modern Radio Design

The transmitter employed must have maximum stability of radiofrequency carrier. Crystal control of its oscillator is imperative. Because the frequency band is 200 to 410 kilocycles, there is no assurance that the frequency of 278 kilocycles will remain the one or only frequency this service may employ. The transmitter should, therefore, be capable of operation on any frequency in this band simply by crystal replacement and adjustment of tuning controls. It is also

(*Continued on page* 101)

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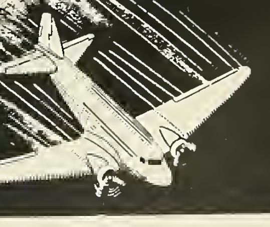

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FUNDAMENTALS OF COMMERCIAL AIRPORT MANAGEMENT

GEORGE W. ORR

President, Roosevelt Field, Inc.

● The requirements for airport management are no different from the requirements of any large, active commercial plant catering to the needs of a specialized industry. The same fundamentals of good business practice and sane economic judgment apply. Naturally, a thorough familiarity with the needs of the pilot and aircraft operator is basic, this being a specialized field, but long experience in plant management, business promotion, credit and accounting, the handling of men, and the machinery of repair and upkeep occupy the greater part of the commercial airport managers' attention. Like any other business, revenue must be found to cover expenditures—otherwise they cannot be made—and in all justice, even though not in experience as yet, there should be a return of profit for the capital invested.

To produce revenue, an aggressive, constant sales and promotion policy should be followed. This policy must include three distinct fields, all reached by different mediums or methods, but each important to complete success. The flier must be sold on using your airport, the manufacturer and operator must be sold on the business opportunity to serve the needs of the fliers, and, finally, your supporting public must be sold on coming to the airport to contribute business to your operators and to furnish from its ranks future customers for aviation.

A proper credit and accounting system must be maintained. For some unexplainable reason, many users of aeronautical service expect unlimited extension of credit as their unquestioned right. This without giving the necessary credit data for such service, for gasoline, oil, repairs, storage or supplies, when they would not dream of making such demands on a store in town. Many expect checks cashed or taken in payment for services or charter flights after ordinary business hours or on holidays when the recipient has no earthly means of verifying the account. Bad credit has been the curse of aviation operators because of lax credit methods. The usual, ordinary credit procedure of any other business is essential.

Accurate cost methods are just as important. Pay day comes as regularly to the airport manager as to the shoe manufacturer. Every service rendered costs money and when services are sold for less than they cost, it is not long (unless unlimited capital is available) before the cupboard is bare. Selling below cost is another millstone around the neck of aviation that has kept its operators' noses to the grindstone and has received little in return except criticism for "the high cost of flying." Costs are "high" only if out of proportion to services rendered. Costs of flying an airplane are remarkably low when the facilities necessary are considered; so low, in fact, that up to the present time practically everybody from the manufacturer to the line service man has lost money.

This is particularly true of the airport. $25 to $35 per month for storage of the usual run of airplanes is bitterly complained of, and yet, considering the space occupied by a plane—to say nothing of the constant and expensive service that is demanded of the hangar operator—such a rate is entirely in line with the garage rate on an automobile, which requires practically no service except space. 30c to 40c per square foot per year is too often called "high" by hangar tenants, when such a rate is less than the rental of a backyard garage at $5 to $7.50 per month. And yet the building to be rented, expensive as it is, is but a beginning of the responsibility, investment, and expense of furnishing and operating the airport that makes that building usable as a hangar. Airports are as indispensable to the use and development of aviation as the wings on a ship, but the cost of furnishing this necessary element is little understood and less appreciated.

A Public Service

An airport is not just a place to land. The requirements for and the cost of operation of a successful airport—one that really furnishes a public service—are many and exacting. It must be large and fairly level, with minimum obstructions. To make this requirement more difficult it should be near a populous center, with good surface communications, and be

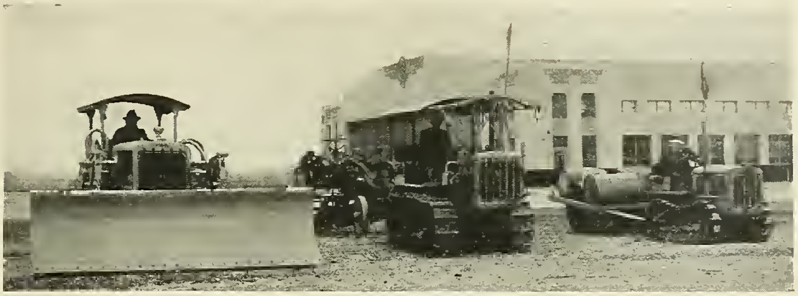
Air view showing part of Roosevelt Field, Mineola, Long Island, N. Y.

convenient to such utilities as water, electricity, gas and sewerage. Such conveniences would make the tract desirable for other uses, so up goes the value of the land and the large initial investment. But that is just the start. The flying area must be graded and drained carefully—usually a tremendous job—the soil must be carefully prepared to receive a crop of sod, and runways and aprons must be built if traffic is heavy or surface uncertain thus requiring hundreds of thousands of square feet of permanent paving.

But still it is not an airport—just a daylight landing field. Hangars, an expensive type of building because of large doors and great open spans, must be built. An operations office and administration building, equipped with radio for weather and perhaps traffic-control, is necessary for housing airport personnel, to serve the flier with information and conveniences, and to care for the public. There must be warehouses for supplies and machinery, a restaurant or perhaps a hotel, with other buildings, shops, stores, etc., to house the needs of the trade. If there is night flying—and there always is on a busy, useful airport—floodlights, beacons, ceiling finder, searchlight, boundary and obstruction lights must be installed.

Maintenance Problems

It costs money to furnish the flying public with an airport. But an airport not carefully, constantly maintained is a hazard and not a help. Maintenance begins with the flying surface and includes care of drainage, filling holes, cutting and replanting grass, repairing runway and roadway surfaces. This requires a great deal of labor and a large investment in machinery. At Roosevelt Field, three Caterpillar tractors of various sizes, a tandem gasoline road roller, a three gang grass mower, large and small power mowing machines, a road grader, half a dozen trucks and a supply of hand tools are included in surface maintenance equipment. The buildings, too, present a constant problem of maintenance and expense; the hundreds of glass windows and skylights, the thousands of square feet of roofing, the doors, heating plants, plumbing and lighting all require constant and expert care. A large airport requires a permanent maintenance staff consisting of Superintendent, skilled mechanics, such as electrician, plumber, auto mechanic, tractor men, painters, carpenters and masons, as well as experienced laborers.



Type of equipment used for field maintenance

Maintenance, important and costly as it is, is only a part of the service required of the modern airport. In addition to the promotion, credit and accounting staff, the management must provide traffic control, policing day and night, weather and general information to fliers and the public, night lighting and often transportation facilities, few, if any, of which produce revenue. Airport hours are long. Sundays and holidays are the busiest days, and so two or more shifts are required for many functions. Traffic control requires attendants in the control tower or office and the constant vigil of experienced fliers to enforce regulations. Radio and control equipment must be purchased and maintained. Policing means 24-hour protection to pilots, public and property. Information means receiving and posting weather information and a personnel competent to answer all questions about flying, schedules, airport personnel and airport business. Night lighting means the purchase, maintenance and current for proper equipment. Electricity costs Roosevelt Field about $150 per month for beacon and boundary lighting alone. Transportation, where necessary, calls for the purchase, maintenance and operation of buses or automobiles.

Who pays for all of this service so necessary to flying? What sources of revenue are available? With prevailing low prices of hangars and storage of planes, the fliers who use the facilities certainly have not paid for them. The owners of commercial airports or the taxpayer, if municipal, have footed a good part of the bill. Disregarding swimming pools, golf courses and amusement park side-shows, which have nothing to do with aviation, the principal sources of legitimate income for the airport, not engaged in flying or service operations, are rental of hangars and space in buildings; concession charges for the sale of food, gasoline, oil, flying instruction and charter flying; charges for scheduled transport operations; and floodlight and landing fees, though the latter charge is seldom imposed in this country. If service and flying operations are engaged in, add the revenue from the sale, storage and repair of aircraft, flying instruction and charter flying.

As may be seen, the problems of airport management are many and require a versatile knowledge of numerous aspects of business and plant management not usually associated with aviation. It is the hope of the writer that this brief and necessarily sketchy recital of some of the problems will result in a better understanding and keener appreciation of the generous and self-sacrificing contribution airport owners, private or civic, have made and are making to the cause of aviation.

Airport hotel lounge-room and a view from the restaurant terrace showing auto parking arrangements

INDEX TO THE MANUFACTURERS OF AIRPORT EQUIPMENT AND AIRPORT PRODUCTS

The following pages contain a directory of the sources of supply of airport equipment and products used at airports. The listings are as complete as could be made with the information available. The accompanying Index indicates the manufacturers listed. Complete data relating to the companies is given in the Directory Section (pages 49 to 64) where manufacturers are listed in alphabetical order.

AIR COMPRESSORS
American Engineering Company
Auto Compressor Company
Brunner Manufacturing Co.
Curtis Pneumatic Machinery Co.
Dayton-Dowd Company
DeVilbiss Company
Gardner-Denver Company
Globe Air Compressor Company
Gould Pumps, Incorporated
Ingersoll-Rand Company
Kellogg Switchboard & Supply Co.
Remington-Rand, Incorporated
Sullivan Machinery Company
U. S. Air Compressor Company

AIR CONDITIONERS
Carrier Engineering Corp.
Champion Pneumatic Mach. Co.

AIR FILTERS
Marshalltown Manufacturing Co.

AIRPORT SHOP EQUIPMENT
American Chain Company, Inc.
Atlas Press Company
Black & Decker Mfg. Co.
Bonney Forge & Tool Works
Cincinnati Machine & Cincinnati Grinders, Incorporated
Cleveland Pneumatic Tool Co.
Delta Manufacturing Company
DeVilbiss Company
Electric Magnetic Tool Company
Fairbanks, Morse & Company
J. A. Fay & Egan Company
Peck, Stow & Wilcox Company
Smith Acetylene & Welding Equip.
Snap-On Company, Inc.
South Bend Lathe Works
U. S. Electrical Tool Company
Weaver Manufacturing Co.

BAGGAGE TRUCKS
Johnson Airplane & Supply Co.
Mercury Manufacturing Company
Karl Ort

BATTERY CHARGERS
John Bean Manufacturing Co.
Burton-Rogers
Forest Electric Company
General Electric Company
Hobart Brothers Company
Interstate Electric Co.
Triple A Specialty Corp.
Valley Electric Company
Weidenhoff Manufacturing Co.

CLEANING EQUIPMENT AND MATERIAL
Homestead Valve Mfg. Co.
Magnus Chemical Co.
F. E. Myers & Bro. Company
Oakite Products, Incorporated

DRAINAGE PIPING
Armco Culvert Mfrs. Assoc.
Denver Sewer Pipe & Clay Co.
Hancock Tile Company
Laclede-Christy Clay Products Co.
Nebraska Culvert & Mfg. Co.
Newport Rolling Mill Company
Walker Cement Products, Inc.
Wheeler Bridge & Lbr.

ELECTRICAL GENERATORS
Autonator Laboratories, Inc.
General Electric Company
Fairbanks, Morse & Company
The Kohler Company
Westinghouse Electric & Mfg. Co.

FENCING
Acme Fence & Iron Company
Alamo Iron Works
American Chain Company
American Steel & Wire Co.
Anchor Post Fence Co.
Colorado Fuel & Iron Prod. Co.
Continental Steel Corporation
Cyclone Fence Company
Standard Fence Company
Stewart Iron Works Co., Inc.
C. H. Tully Fence Company

FIRST AID EQUIPMENT
Bauer & Black
E. D. Bullard Company
Burroughs Wellcome & Co., Inc.
Davis Emergency Equipment Co.
Johnson & Johnson
Mine Safety Appliance Co.
Seabury & Johnson

FIRE FIGHTING EQUIPMENT

Fire Extinguishers
American-La France & Foamite Industries, Inc.
Badger Fire Extinguisher Co.
Buffalo Fire Appliance Co.
Dayton Fire Extinguisher Co.
Fyr Fyter Company
Garrison Engineering Corp.
General Fire Truck Corp.
Johnson Airplane & Supply Co.
Walter Kidde & Company
The Phister Manufacturing Co.
Pyrene Manufacturing Co.
Stempel Fire Exting'sher Mfg. Co.

FUEL SYSTEMS
Aqua Systems, Inc.
Gilbert & Barker Mfg. Co.
S. F. Bowser & Company

GRADING & MAINTENANCE EQUIPMENT
Buffalo-Springfield Roller Co.
Detroit Harvester Company
Eversman Mfg. Co., Inc.
Ideal Manufacturing Co.
International Harvester Co. of America, Inc.
Killifer Manufacturing Co.
W. A. Riddell Company
Russell Grader Mfg. Co.
Toro Manufacturing Co.
James H. Tower Iron Works

HANGARS, HANGAR EQUIPMENT
Allith-Prouty Manufacturing Co.
Austin Company
C. O. Barton Company
Butler Manufacturing Co.
Esline Company
Hauenstein & Burmeister, Inc.
Ingalls Iron Works
International Steel & Iron Co.
Lincoln Steel & Forge Co.
Lincoln Steel Works
Maryland Metal Building Co.
F. E. Myers & Bro. Co.
Mississippi Valley Structural Steel Co.
Muskogee Iron Works
Orange Car & Steel Co.
Richards-Wilcox
Roanoke Bridge & Iron Works
Stefco Steel Co.
Truscon Steel Co.
Virginia Bridge & Iron Co.
Western Pipe & Steel Co.

HANGAR DOORS
American Rolling Mill Co.
American Sheet & Tin Plate Co.
Detroit Steel Products Co.
Esline Company
Hauenstein & Burmeister, Inc.
Ingalls Iron Works
Muskogee Iron Works
Orange Car & Steel Company
Richards-Wilcox
Roanoke Bridge & Iron Works
Stefco Steel Company
Truscon Steel Company
Western Pipe & Steel Co.

HANGAR HEATERS
American Blower Corp.
Amer. Heating & Ventilating Co.
American Radiator Co.
Automatic Fan & Blower Co.
Bryant Heater Company
Buffalo Forge Company
C. A. Dunham Company
Grinnel Bros., Inc.
Humphrey Company
Kewanee Boiler Corp.
Leif Lee Heating Engineers
Herman Nelson Corporation
Pecco, Incorporated
Skinner Bros. Mfg. Co., Inc.
Trane Company
York Heating & Ventilating Corp.

LIGHTING EQUIPMENT

Beacons
Air Associates, Inc.
American Gas Accumulator
Crouse-Hinds Company
General Electric Company
Lights, Incorporated
Pyle-National Company
Sperry Gyroscope Company
Westinghouse Electric & Mfg. Co.

Buoys
Jaeger Machine Company

Boundary Lights
American Gas Accumulator
Crouse-Hinds Company
Cutler-Hammer, Inc.
General Electric Company
Jaeger Machine Company
Martin Electric Company
Pyle-National Company
Westinghouse Electric & Mfg. Co.

Flood Lights
American Gas Accumulator
S. F. Bowser & Company
General Electric Company
Martin Electric Company
Pyle-National Company
Westinghouse Electric & Mfg. Co.

Obstruction Lights
American Gas Accumulator
Crouse-Hinds Company
General Electric Company
Jaeger Machine Company
Pyle-National Company
Westinghouse Electric & Mfg. Co.

Runway Lights
American Gas Accumulator
Cutler-Hammer, Inc.
General Electric Company
Jaeger Machine Company
Westinghouse Electric & Mfg. Co.

Lighting Cable
Anaconda Wire & Cable Co.
Belden Manufacturing Co.
General Cable Corp.
General Electric Company
Hazard Insulated Wire Works
Kerite Insulated Wire & Cable Co.
John A. Roebling's Sons Co.
Westinghouse Electric & Mfg. Co.

LOCKERS
All-Steel-Equip. Co., Inc.
Berger Manufacturing Co.
Charpiot Safe Company
Durabilt Steel Locker Co.
General Fireproofing Co.
Lyon Metal Products, Inc.
Fred Medart Mfg. Co.
S. S. Mosher Company
OCS Manufacturing Co.
Penn. Metal Co. of Pennsylvania
Shaw-Walker Company
Terrells Equipment Co.

PETROLEUM
American Oil Company
Associated Oil Company
Continental Oil Company
Crusader Oil Corporation
Ethyl Gasoline Corp.
Fiske Brothers Refining Co.
Garland Products Co., Inc.
Gulf Refining Company
Humble Oil & Refining Co.
Kendall Refining Company
Pennzoil Company
Phillips Petroleum Company
Pure Oil Company
Pyroil Company
Quaker State Oil Refining Co.
Richfield Oil Company of Calif.
Shell Petroleum Corporation
Sinclair Refining Company
Skelly Oil Company
Socony-Vacuum Company, Inc.
Stanavo Specification Board
Texas Company
White Star Refining Company
Wolverine-Empire Refining Co.

PORTABLE STARTERS
Briggs & Stratton Corp.
Cleveland Pneumatic Tool Co.
Eclipse Aviation Corp.
Valley Electric Company

PUBLIC ADDRESS SYSTEMS
Capehart Corporation
General Electric Company
Jensen Radio Manufacturing Co.
Operadio Manufacturing Co.
RCA Manufacturing Co., Inc.
Remler Company, Incorporated
Universal Microphone Co.

PUMPS

Air

Curtis Pneumatic Machinery Co.
Ingersoll-Rand Company
Remington-Rand, Inc.
Tokheim Oil Tank & Pump Co.
U. S. Air Compressor Co.

Fuel

Butler Mfg. Company
Erie Pump & Equipment Co.
Gilbert & Barker Mfg. Co.
Kraissl Company
Pump Engineering Service Corp.
Sharpesville Boiler Works Co.
Tokheim Oil Tank & Pump Co.
Wayne Company

Oil

Bennett Pump Corporation
Gilbert & Barker Mfg. Co.
Geo. D. Roper Corporation
Tokheim Oil Tank & Pump Co.

Sump

Goulds Pumps, Inc.

Sewage

Goulds Pumps, Inc.

Power

F. E. Myers & Bro. Company

Water

C. H. & E. Manufacturing Co.
Chicago Pump Co.
Dayton-Dowd Company
Fairbanks, Morse & Co.
Goulds Pumps, Inc.
F. E. Myers & Bro. Company
Nash Engineering Company
Pomona Pump Co.
Wagner Steam Pump Co.
Westco Pump Corporation
Worthington Pump & Mchy. Corp.

Accessories

Ralph N. Brodie Company

PURIFIERS

Goulds Pumps, Inc.

RADIO

Breting Radio Company
Crosley Radio Corporation
General Electric Company
National Company, Inc.
Philco Radio & Television Corp.
Radio Navigational Instrmt. Co.
RCA Manufacturing Company
Western Electric Company
Westinghouse Electric & Mfg. Co.
Zenith Radio Corporation

SIRENS

E. D. Bullard Company
W. S. Darley Company
Federal Electric Co., Inc.
Robbins & Myers, Inc.
Sterling Siren Fire Alarm Co., Inc.

SPRINKLER SYSTEMS

Grinnel Brothers, Inc.
Viking Corporation

SURFACING MATERIAL

Barber Asphalt Company
Barrett Company
Berry Asphalt Company
Gilmore Oil Company
Koppers Products Company
Portland Cement Association
Texas Company
Warner-Quinlan Company
Westinghouse Electric & Mfg. Co.

TRACTORS

Allis-Chalmers Manufacturing Co.
Caterpillar Tractor Company
Clark Tructractor Company
Cleveland Tractor Company
International Harvester Co. of America, Inc.
Massey-Harris Company
Mercury Manufacturing Co.
Toro Manufacturing Co.

VALVES

Hoffman Specialty Company

WEATHER INDICATORS

Wind Cones

Air Associates, Inc.
Crouse-Hinds Company
Karl Ort

Wind Socks

George Faat
C. J. Hoigard Manufacturing Co.
Johnson Airplane & Supply Co.
OCS Manufacturing Co.

Wind Tees

Aircraft Industries, Inc.
Aircraft Service, Inc.
Grand Island Culvert & Met. Wks.
Karl Ort
Pyle-National Company
Qualls Electric Company
Rad-i-cone Mfg. Company

WEATHER INSTRUMENTS

American Paulin System
Brown & Sharpe Mfg. Co.
J. P. Friez & Sons
Henry J. Green
Taylor Instrument Co.
Warren Telechron Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.
Wissler Instrument Company

Manufacturers of Airport Equipment and Products

ACME FENCE & IRON CO.
3502 Lake Ave., Cleveland, Ohio

Airport equipment: Fencing.

AIR ASSOCIATES, INC.
Roosevelt Field, Long Island, N. Y.

F. Leroy Hill, president and general manager; H. I. Crow, secretary, treasurer, general sales manager; Sam Breder, manager of manufacturers sales. Branch managers: Ray Acre (Chicago); Ted Lynn, (Glendale).

Branch offices: 5300 W. 63 St., Chicago, Ill.; 1200 Airway, Glendale, Calif.

Airport equipment: Wind cones; wind direction indicators. Beacon lights.

AIRCRAFT INDUSTRIES, INC.
Grand Central Air Terminal, Glendale, Calif.

Airport equipment: Wind tees.

AIRCRAFT SERVICE, INC.
Cleveland Airport, Cleveland, Ohio

Airport equipment: Wind tees (*Pilot Tee*).

ALAMO IRON WORKS, San Antonio, Tex.

Airport equipment: Fencing.

ALLIS-CHALMERS MANUFACTURING CO.
1126 S. 70th, Milwaukee, Wis.

W. A. Roberts, general sales manager, tractor division; H. C. Merritt, manager, tractor division.

Airport equipment: Tractors.

ALLITH-PROUTY MFG. CO., Danville, Illinois

R. B. Older, general manager and chief engineer; N. B. Hart, sales and advertising manager.

Airport equipment: Hangar and fire door hardware. Hangars. Track for sliding doors.

ALL-STEEL-EQUIP CO., INC., Aurora, Ill.

John Knell, president; F. R. McQuown, vice-president and general sales manager; Norman L. Pearson, sales manager, industrial division.

Airport equipment: Steel lockers.

AMERICAN BLOWER CORPORATION
6000 Russell St., Detroit, Mich.

Branch offices: Marietta St. Bldg., Atlanta, Ga.; Court Square Bldg., Baltimore, Md.; Webb Crawford Bldg., Birmingham, Ala.; Statler Bldg., Boston, Mass.; White Bldg., Buffalo, N. Y.; Commercial Bank Bldg., Charlotte, N. C.; 228 N. LaSalle St., Chicago, Ill.; American Bldg., Cincinnati, O.; Swetland Bldg., Cleveland, O.; Mercantile Bldg., Dallas, Tex.; 1460 24 St., Denver, Colo.; Hofman Bldg., Detroit, Mich.; P. O. Box 512, 401 N. Santa Fe, El Paso, Tex.; 625 Architects & Builders Bldg., Indianapolis, Ind.; Mutual Bldg., Kansas City, Mo.; 408 Southern Bldg., Little Rock, Ark.; 429 Shell Bldg., Los Angeles, Calif.; Majestic Bldg., Milwaukee, Wisc.; Essex Bldg., Minneapolis, Minn.; 402 Broad St., Newark, N. J.; 846 Baronne St., New Orleans, La.; 401 Broadway, New York, N. Y.; 322-4 W.O.W. Bldg., Omaha, Nebr.; Otis Bldg., Philadelphia, Pa.; 1433 Oliver Bldg., Pittsburgh, Pa.; Pacific Bldg., Portland, Ore.; Railway Exchange Bldg., St. Louis, Mo.; Dooly Bldg., Salt Lake City, Utah; Rialto Bldg., San Francisco, Calif.; Imperial Bldg., Schenectady, N. Y.; 1534 First Ave., S., Seattle, Wash.; 1127 St. Paul Ave., Tacoma, Wash.; 514 Woodward Bldg., Washington, D. C.

Airport equipment: Hangar heaters (*Sirocco*).

AMERICAN CHAIN COMPANY, INC.,
Bridgeport, Conn.

Sales managers: O. R. McDonald, Manley Manufacturing Division (York); W. H. Bleecker, Page Steel & Wire Division (Monessen); R. C. Blair, Wright manufacturing Division (York).

Factories: Bridgeport, Conn.; York, Braddock, and Monessen, Pa.

Branch offices: New York, N. Y.; Boston, Mass.; Chicago, Ill.; York, Pa.; San Francisco, Calif.; Pittsburgh, Pa.; Detroit, Mich.

Airport equipment: *Manley* jacks. Trestles. Motor stands. Link fencing (*Page*). Hoists (*Wright*).

AMERICAN ENGINEERING CO.
Aramingo & Cumberland, Philadelphia, Pa.

W. V. Sauter, president; W. C. Williamson, vice-president; C. L. Cushmore, secretary and treasurer; J. G. Worker, general sales manager.

Airport equipment: Air compressors.

AMERICAN GAS ACCUMULATOR CO.
Elizabeth, New Jersey

L. M. Merrill, chairman management committee; V. L. Oestnaes, chief engineer; L. C. Simpson, manager airport lighting division (Washington). Representatives: F. A. Gurdes (Chicago); J. L. Herrmann (Pittsburgh); R. L. Atwell (Richmond); C. A. Ward (Peoria); T. W. Masterson, Jr. (Houston).

Branch offices: Washington, D. C.; New York, N. Y.; Chicago, Ill.; Pittsburgh, Pa.; Richmond, Va.; Peoria, Ill.; Houston, Tex. Sperry Gyroscope Co., Inc. (West Coast representative); Wilmington, Los Angeles; San Francisco, Calif., Seattle.

Airport equipment: Lights (beacons: wind tees; wind cones; marker; boundary; range; obstruction; roof marking; flood; ceiling projectors; ceiling height indicators).

AMERICAN HEATING & VENTILATING CO.
Philadelphia, Pennsylvania

Airport equipment: Hangar heaters.

AMERICAN-LA FRANCE & FOAMITE INDUSTRIES, INC. Elmira, New York

W. R. Rollo, manager, aviation department.

Airport equipment: Fire extinguishers (*Foamite Crusader; Foamite* engine; *Alfite*).

AMERICAN OIL CO., Baltimore, Md.

Jacob Blaustein, president; Alvin Thalheimer, vice-president; D. H. Baker, secretary; J. A. Carroll, Jr., treasurer; J. W. Carney, general sales manager; F. A. Colonell, sales manager.

Airport products: Petroleum (*Amoco* gasoline; oil).

(*Continued on following pages*)

Manufacturers of Airport Equipment and Products

AMERICAN PAULIN SYSTEM
1847 S. Flower St., Los Angeles, Calif.

Airport equipment: Barometers.

AMERICAN RADIATOR COMPANY
40 West 40 Street, New York, N. Y.

Arthur R. Herske, vice-president and general manager of sales; Marshall Adams, sales production manager; Max D. Rose, vice-president and eastern sales manager; D. E. Kennedy, vice-president and western sales manager; William E. Kugeman, vice-president and export manager.

Airport equipment: Hangar heaters.

THE AMERICAN ROLLING MILL COMPANY
Middletown, Ohio

G. F. Ahlbrandt, general sales manager; H. M. Richards, assistant general sales manager; E. A. Emerson, export manager.

Airport equipment: Hangar doors.

AMERICAN SHEET & TIN PLATE CO.
Frick Bldg., Pittsburgh, Pa.

C. W. Bennett, president; D. A. Barrett, vice-president; F. C. Harper, vice-president and sales manager.

Airport equipment: Hangar doors.

AMERICAN STEEL AND WIRE COMPANY
208 S. La Salle St., Chicago, Ill.

C. F. Blackmer, president; C. F. Hood, vice-president; A. F. Allen, secretary-treasurer; F. E. Chesney, purchasing agent (Cleveland); D. A. Merriman, vice-president and general manager of sales; W. A. Cordes, advertising manager (Chicago).

Branch offices: 101 Marietta St., Atlanta, Ga.; First National Bank Bldg., Baltimore, Md.; Brown-Marx Bldg., Birmingham, Ala.; Statler Bldg., Boston, Mass.; 670 Ellicott St., Buffalo, N. Y.; Union Trust Bldg., Cincinnati, O.; Rockefeller Bldg., Cleveland, O.; Praetorian Bldg., Dallas, Tex.; First National Bank Bldg., Denver, Colo.; Buhl Bldg., Detroit, Mich.; 417 Grand Ave., Kansas City, Mo.; Sterick Bldg., Memphis, Tenn.; Bankers Bldg., Milwaukee, Wisc.; Merchants National Bank Bldg., St. Paul, Minn.; 30 Church St., New York, N. Y.; Hales Bldg., Oklahoma City, Okla.; Widener Bldg., Philadelphia, Pa.; Frick Bldg., Pittsburgh, Pa.; Walker Bank Bldg., Salt Lake City, Utah; 506 Olive St., St. Louis, Mo.; Miners Bank Bldg., Wilkes-Barre, Pa.; 94 Grove St., Worcester, Mass. Columbia Steel Co. (Pacific Coast Distributors): Russ Bldg., San Francisco, Calif.; 2087 E. Slauson Ave., Los Angeles, Calif.; 777 Nicolai St., Portland Ore.; 4th Ave., S., & Connecticut St., Seattle, Wash.; Castle & Cook Bldg., Honolulu, H. I.

Airport equipment: Fencing.

AMERICAN TELEPHONE & TELEGRAPH CO.
195 Broadway, New York, N. Y.

Walter S. Gifford, president; R. H. Strahan, secretary; J. F. Behan, treasurer.

Airport equipment: Teletype.

ANACONDA WIRE & CABLE COMPANY
25 Broadway, New York, N. Y.

Airport equipment: Cable.

ANCHOR POST FENCE CO., Baltimore, Md.

Factories: Baltimore, Md.; Cleveland, Ohio.

Branch offices: Home Savings Bank Bldg., Albany, N. Y.; 238 Main St., Cambridge, Mass.; Jackson Bldg., Buffalo, N. Y.; 333 N. Michigan Ave., Chicago, Ill.; Builder's Exchange Bldg., Cleveland, Ohio; Architects' Bldg., Detroit, Mich.; 43 Farmington Ave., Hartford, Conn.; 167 Jericho Turnpike, Mineola, L. I., N. Y.; 9 E. 38th St., New York, N. Y.; 1060 Broad St., Newark, N. J.; Broad St. & Allegheny Ave., Philadelphia, Pa.; 460 Fifth St., San Francisco, Calif.; 18 Depot Plaza, White Plains, N. Y.

Airport equipment: Fencing.

AQUA SYSTEMS, INCORPORATED,
2443 Third Ave., New York, N. Y.

Charles F. Beckwith, president; A. C. Kaestner, secretary-treasurer.

Airport equipment: Fueling systems.

ARMCO CULVERT MFRS. ASSOCIATION
Middletown, Ohio

Airport equipment: Drainage (*Armco* corrugated metal pipe for sewers and stream enclosures; paved invert pipe; perforated pipe for subdrainage of fields, runways, etc.; automatic drainage gates; metal crib retaining walls; multi plate pipe and arches for large drains; part circle culverts).

ASSOCIATED OIL COMPANY
79 New Montgomery, San Francisco, Calif.

William F. Humphrey, president; L. F. Bayer, vice-president in charge of manufacturing; B. I. Graves, vice-president in charge of sales; L. D. Jurs, vice-president in charge of engineering; J. P. Edwards, secretary; W. A. Sloan, treasurer; P. E. Allan, sales manager; R. S. Turner, export manager.

Airport products: Petroleum (*Flying A* gasoline; *Cycol* engine oils and greases).

ATLAS PRESS CO., Kalamazoo, Mich.

Airport equipment: Machinery (drill presses; lathes; grinders; motors; hydraulic and arbor presses).

THE AUSTIN COMPANY, Cleveland, Ohio

W. J. Austin, president and general manager; G. A. Bryant, Jr., executive vice-president; Albert S. Low, vice-president and chief engineer; C. W. Kinnison, secretary-treasurer.

Branch offices: 19 Rector St., New York, N. Y.; 510 N. Dearborn St., Chicago, Ill.; Commercial Trust Bldg., Philadelphia, Pa.; 2842 W. Grand Blvd., Detroit, Mich.; Union Trust Bldg., Pittsburgh, Pa.; Dexter Horton Bldg., Seattle, Wash.; Porter Bldg., Portland, Ore.; 516 18th St., Oakland, Calif.; The Austin Company of California, 777 E. Washington St., Los Angeles, Calif.

Airport equipment: Airport structures.

AUTO COMPRESSOR CO., Wilmington, Ohio

Airport equipment: Air compressors.

AUTOMATIC FAN & BLOWER COMPANY
1805 N. Kostner, Chicago, Ill.

Airport equipment: Hangar heaters.

AUTONATOR LABORATORIES, INC.
8449 S. Chicago Ave., Chicago, Ill.

Airport equipment: Electrical generators.

B

BADGER FIRE EXTINGUISHER CO.
Park Square Bldg., Boston, Mass.

Branch office: 123 William St., New York, N. Y.

Airport equipment: Fire extinguishers (soda-acid; foam).

BARBER ASPHALT COMPANY
1600 Arch Street, Philadelphia, Pa.

Airport products: Runway surfacing materials.

THE BARRETT CO.
40 Rector St., New York, N. Y.

E. W. Clark, president; Alfred L. Loebenberg, vice-president; R. L. Cammann, director of sales; E. R. Snyder, general manager.

Airport products: Surfacing materials.

C. O. BARTON COMPANY
1900 E. Jefferson, Detroit, Michigan

Airport equipment: Hangers.

BAUER & BLACK
2500 S. Dearborn, Chicago, Ill.

R. A. Whidden, president; C. K. Perkins, vice-president and general sales manager; H. B. Crow, sales manager; J. R. Strohecker, assistant general sales manager.

Airport equipment: First aid kits.

JOHN BEAN MANUFACTURING CO.
217 W. Julian, San Jose, Calif.

J. D. Crummey, president; Paul Davies, vice-president and treasurer; Ogden S. Sells, general sales manager; F. A. Hanson, advertising and sales manager; F. L. Burrell, general manager.

Airport equipment: Battery chargers.

BELDEN MANUFACTURING COMPANY
4647 W. Van Buren, Chicago, Ill.

J. C. Belden, president; N. B. Parsons, vice-president; Whipple Jacobs, vice-president; H. W. Clough, sales manager; Knud Nielsen, export manager.

Airport equipment: Steel cable.

BENNETT PUMP CORP., Muskegon, Mich.

Airport equipment: Oil pumps.

THE BERGER MANUFACTURING CO.
1038 Belden Ave., N.E., Canton, Ohio

B. F. Fairless, president; L. S. Hamaker, vice-president and general manager; W. C. Gubbins, secretary and treasurer; J. W. Strong, general sales manager; L. W. Shorter, export manager.

Manufacturers of Airport Equipment and Products (Continued)

Airport equipment: Steel lockers (*Berloy*).

BERRY ASPHALT COMPANY
6 N. Michigan Ave., Chicago, Ill.

Airport products: Surfacing materials.

BLACK & DECKER MANUFACTURING CO.
700 Pennsylvania Ave., Towson, Md.

S. Duncan Black, president; Alonzo G. Decker, vice-president and general manager; Charles J. Fox, second vice-president; Benjamin T. Ridgely, third vice-president; Frank J. Nagell, treasurer; Charles A. Sacra, secretary.

Branch offices: Boston, Mass.; New York, N. Y.; Philadelphia, Pa.; Baltimore, Md.; Atlanta, Ga.; Cleveland, O.; Chicago, Ill.; Kansas City, Mo.; Detroit, Mich.; Oakland, Calif.; Buffalo, N. Y.; Minneapolis, Minn.; Dallas, Tex.; St. Louis, Mo.; Montreal and Toronto, Canada.

Airport equipment: Portable electric tools (electric hand drills; valve refacers; hole saws; *Torsimeter* screw drivers; nut runners; grinders; sanders; planers; polishers; bench grinders; valve seat grinders and cutters). Drill stands. Electric drill accessories. Socket wrenches. Wire wheel bushes. Heat guns.

BLACKMER PUMP COMPANY
1809 Century Ave., S.W. Grand Rapids, Mich.

A. B. Klise, chairman; R. G. Klise, assistant to chairman; A. L. Rock, export manager; B. P. Hetler, advertising and general sales manager.

Airport equipment: Rotary pumps.

BONNEY FORGE & TOOL WORKS,
Allentown, Pa.

A. J. Male, manager, aviation sales.

Airport equipment: Aircraft engine wrenches.

S. F. BOWSER & CO., Fort Wayne, Ind.

E. C. Marsh, general sales manager; H. E. Dobson, export representative, and J. A. Forsythe, manager (New York). Managers: I. D. Bone (Albany); H. W. Luhmann (Boston); J. A. Merrill (Chicago); H. W. Stahl (Cleveland); C. R. Huston (St. Louis); C. A. Weego (Dallas); D. C. Price (Detroit); R. R. Dooley (Philadelphia); W. F. McAuley (San Franscisco).

Branch offices: 1011 Broadway, Albany, N. Y.; Park Square Bldg., Boston, Mass.; 2011 S. Michigan Ave., Chicago, Ill.; 1514 Prospect Ave., Cleveland, O.; 3615 Olive St., St. Louis, Mo.; 1615 Bryan St., Dallas, Tex.; 2051 W. Lafayette Blvd., Detroit, Mich.; 135 E. 42 St., New York, N. Y.; Insurance Co. of N. America Bldg., Philadelphia, Pa.; 468 Ninth St., San Francisco, Calif.

Airport equipment: Fueling systems. Recording devices (*Xacto*). Rotary pumps. Pipe line strainers. Air release units. Floodlights. Float suction units. Centrifugal filters. Hose nozzles.

BRETING RADIO CO., Los Angeles, Calif.

Airport equipment: Radio.

BRIGGS & STRATTON CORPORATION
2711 N. 13th, Milwaukee, Wisc.

S. F. Briggs, president; C. L. Coughlin, vice-president; E. Bodendoerfer, secretary; E. V. Oehler, advertising and general sales manager.

Airport equipment: Portable starters.

RALPH N. BRODIE CO.
61st & Lowell, Oakland, Calif.

Airport equipment: Pump accessories (fly wheel bands; gears).

BROWN & SHARPE MANUFACTURING CO.
235 Promenade, Providence, R. I.

H. D. Sharpe, president and treasurer; vice-presidents: W. A. Viall and P. C. DeWolf; H. Buker, vice-president and general sales manager.

Airport equipment: Protractors.

THE BRUNNER MANUFACTURING CO.
1821 Broad, Utica, N. Y.

L. J. Brunner, chairman of the board; G. L. Brunner, president and treasurer; W. C. Allen, vice-president and sales manager; M. H. Pendergast, vice-president and factory manager.

Airport equipment: Air compressors.

BRYANT HEATER COMPANY
18725 St. Clair Ave., Cleveland, Ohio

H. N. Mallon, president; L. C. Harvey, vice-president and sales manager; R. E. Reimer, treasurer.

Airport equipment: Hangar heaters.

BUFFALO FIRE APPLIANCE CO., Buffalo, N. Y.

Airport equipment: Fire extinguishers.

BUFFALO FORGE CO., Buffalo, N. Y.

Airport equipment: Heaters (unit gas; steam).

THE BUFFALO-SPRINGFIELD ROLLER CO.
Springfield, Ohio

Branch offices: Brisbane Bldg., Buffalo, N. Y.; 3703 Powelton Ave., Philadelphia, Pa.; 11 Carleton St., Cambridge, Mass.; 150 Nassau St., New York, N. Y.

Airport equipment: Maintenance apparatus (rollers).

E. D. BULLARD COMPANY
275-8th St., San Francisco, Calif.

Branch offices: 1229 S. Olive St., Los Angeles, Calif.; 1620 Yalecrest Ave., Salt Lake City, Utah; 215 S. Leavitt St., Chicago, Ill.; 1 Main St., Houston, Tex.

Airport equipment: Sirens. First aid kits.

BURROUGHS WELLCOME & COMPANY, INC.
9-11 E. 41st St., New York, N. Y.

Airport equipment: First aid kits.

BURTON-ROGERS, Boston, Mass.

Airport equipment: Battery chargers.

BUTLER MANUFACTURING COMPANY
13th & Eastern Ave., Kansas City, Mo.

E. E. Norquist, president; C. C. Crouch, vice-president and director of sales; Oscar D. Nelson, treasurer and general manager.

Airport equipment: Hangars. Fuel pumps.

C

THE CAPEHART CORPORATION
E. Pontiac St., Ft. Wayne, Ind.

F. W. Gigax, vice-president and general manager; P. H. Hartman, secretary; J. F. Ratliff, treasurer; I. C. Hunter, advertising and general sales manager; W. J. Platka, export manager.

Airport equipment: Public address systems.

CARRIER ENGINEERING CORPORATION
850 Frelinghuysen Ave., Newark, N. J.

J. I. Lyle, president; Thornton Lewis, executive vice-president; C. R. Lyle, vice-president and sales manager; Chas. J. Staples, secretary; M. S. Smith, treasurer.

Airport equipment: Air conditioning apparatus.

CATERPILLAR TRACTOR CO., Peoria, Illinois.

W. H. Gardner, manager, special sales division; W. K. Cox, supervisor, industrial sales; E. R. Galvin, sales manager.

Factories: Peoria, Ill.; San Leandro, Calif.

Warehouses: Learned St., Albany, N. Y.; Kansas City, Kans.; Memphis, Tenn.; Minneapolis, Minn.; Moose Jaw, Saskatchewan, Canada; Spokane, Wash.

Branch offices: 50 Church St., New York, N. Y.; Munsey Bldg., Washington, D. C.

Airport equipment: Tractors. Maintenance machinery (*Auto Patrol; Hi-Way Patrol; Trailer Patrol; Motor Patrol;* elevating graders; blade graders; power units).

THE CEMENT INSTITUTE
11 E. 44th St., New York, N. Y.

Airport equipment: Surfacing materials.

CHAMPION PNEUMATIC MACHINERY CO.
8164 S. Chicago Ave., Chicago, Ill.

Geo. T. Rayfield, president, general manager and purchasing agent; Samuel Schlosser, vice-president; C. H. Lee, secretary, advertising manager and general sales manager; Fred J. Rayfield, treasurer.

Airport equipment: Air conditioning apparatus.

CHARPIOT SAFE COMPANY
1650 Blake St., Denver, Colo.

Airport equipment: Lockers.

C. H. & E. MANUFACTURING COMPANY
281 Mineral St., Milwaukee, Wisc.

Airport equipment: Water pumps.

CHICAGO PUMP COMPANY
2337 Wolfrom St., Chicago, Ill.

Airport equipment: Water pumps.

CINCINNATI MACHINE & CINCINNATI GRINDERS, INCORPORATED, Cincinnati, Ohio

Philip O. Geier, chairman and treasurer; Frederick V. Geier, president; Walter W. Tangeman, vice-president; Ferris M. Angevin, secretary.

Airport equipment: Milling machine and attachments. Grinding machines.

(*Continued on following pages*)

Manufacturers of Airport Equipment and Products (Continued)

CLARK TRUCTRATOR CO.
Battle Creek, Mich.

R. J. Burrows, president; Ezra W. Clark, vice-president in charge of advertising; A. S. Bonner, secretary and treasurer.

Airport equipment: Tractors.

THE CLEVELAND PNEUMATIC TOOL CO.
3734 East 78 Street, Cleveland, Ohio.

Claus Greve, chairman of the board; L. W. Greve, president; H. W. Foster, vice-president; A. F. Barner, secretary; J. DeMooy, treasurer; S. Scott, superintendent; E. W. Cleveland, manager automotive-aircraft division.

Branch offices: 30 Church St., New York, N. Y.; 80 Federal St., Boston, Mass.; 401 N. Broad St., Philadelphia, Pa.; Clark Bldg., Pittsburgh, Pa.; Insurance Exchange Bldg., Detroit, Mich.; Railway Exchange Bldg., Chicago, Ill.; Railway Exchange Bldg., St. Louis, Mo.; 1306 N. 1st Ave., Birmingham, Ala.; 1307 E. 17th St., Columbus, Ohio.

Airport equipment: Pneumatic tools (*Cleco* riveters for dural; polishers and grinders; air drills; sanders, engine starters).

THE CLEVELAND TRACTOR COMPANY
19300 Euclid Ave., Cleveland, Ohio

W. King White, president and treasurer; J. G. Heaslet, vice-president; J. H. Leisenheimer, vice-president; Grover Higgins, secretary; W. E. Miles, general sales manager; G. W. Pickering, sales manager.

Airport equipment; Tractors (*Cletrac*).

COLORADO FUEL & IRON PRODUCTS CO.
Continental Oil Bldg., Denver, Colo.

D. C. Gardner, manager, chain link fence division.

Factory: Pueblo, Colo.

Airport equipment: Fencing.

CONTINENTAL OIL CO., Ponca City, Okla.

W. W. Bruce, executive vice-president; G. F. Smith, treasurer; H. J. Kennedy, general sales manager.

Airport equipment: Petroleum (*Conoco* gasoline; oil).

CONTINENTAL STEEL CORP., Kokomo, Ind.

Branch offices: Indianapolis, Ind. Canton, Ohio.

Airport equipment: Fencing (chain link).

THE CROSLEY RADIO CORPORATION
Arlington & Colerain, Cincinnati, Ohio

Powel Crosley, Jr., president and treasurer; Lewis M. Crosley, vice-president and general manager; Charles Sawyer, vice-president; L. K. Kellogg, secretary; H. E. Richardson, sales manager.

Airport equipment: Radio receivers.

CROUSE-HINDS CO., Syracuse, N. Y.

H. B. Crouse, president; W. L. Hinds, vice-president; C. M. Crofoot, vice-president; F. F. Skeel, vice-president; A. F. Hills, secretary; W. C. Blanding, treasurer.

Branch offices: Majestic Bldg., Milwaukee, Wisc.; Sheldon Bldg., San Francisco, Calif.; 4 N. Eighth St., St. Louis, Mo.; 407 S. Dearborn St., Chicago, Ill.; 1008 Marquette Ave., Minneapolis, Minn.; 1207 E. 8th St., Los Angeles, Calif.; Interurban Bldg., Dallas, Tex.; 30 Church St., New York, N. Y.; Dixie Terminal Bldg., Cincinnati, O.; 112 S. 16th St., Philadelphia, Pa.; General Motors Bldg., Detroit, Mich.; 113 Lincoln St., Boston, Mass.; Empire Bldg., Pittsburgh, Pa.; Hanna Bldg., Cleveland, O.

Airport equipment: Lights (beacons; obstruction lights; roof sign fittings; searchlights; floodlights, projectors; boundary lights; obstacle and approach lights; on course-lights; ceiling indicators). Wind cone fixture and supports. Marker cones and wings. Underground junction boxes. Weatherproof transformer housings. Electrical relays. Control panels and cabinets. Wind direction indicators. Lighting equipment (pipe hangars; junction boxes; lighting circuit controls; bushings; connectors). Interior illumination equipment (reflectors; hand lamps; plugs, receptacles; incandescent lamps).

CRUSADER OIL CORPORATION
30 Broad St., New York, N. Y.

Erwin Watts, president; Capt. Homer Berry, aviation sales manager.

Airport products: Petroleum (*Blue Shield* oil).

CURTIS PNEUMATIC MACHINERY CO.
1902 Kienlen, St. Louis, Mo.

W. C. Hecker, president; F. Ackerman, vice-president; C. W. Frees, secretary and treasurer; L. C. Blake, advertising and sales promotion manager; J. D. Lodwick, sales manager.

Airport equipment: Air compressors. Air pumps.

CUTLER-HAMMER, INCORPORATED
12th & St. Paul, Milwaukee, Wisc.

F. R. Bacon, president; F. L. Pierce, vice-president; W. C. Stevens, secretary; H. F. Vogt, treasurer; Forrest U. Webster, manager of merchandising sales; G. S. Crane, general sales manager.

Airport equipment: Lights (boundary; runway).

CYCLONE FENCE CO., Waukegan, Ill.

C. F. Blackmer, president; A. F. Allen, secretary; W. F. Kirkham, treasurer; R. E. Pinniger, general sales manager.

Airport equipment: Fencing.

D

W. S. DARLEY COMPANY
2810 W. Washington Blvd., Chicago, Ill.

Airport equipment: Sirens.

DAVIS EMERGENCY EQUIPMENT CO., INC.
55 Van Dam St., New York, N. Y.

Branch offices: Chicago, Ill.; Dallas, Tex.; San Francisco, Calif.

Airport equipment: First aid kits.

DAYTON-DOWD CO., 360 York St., Quincy, Ill.

Airport equipment: Water pumps. Air compressors.

DAYTON FIRE EXTINGUISHER CO., Dayton, O.

Airport equipment: Fire extinguishers.

DELTA MANUFACTURING COMPANY
3775 N. Holton, Milwaukee, Wisc.

H. E. Tautz, president and treasurer; R. C. Beck, vice-president; M. Doyle, secretary; R. Melius, general sales manager.

Airport equipment: Drill presses. Portable woodworking machinery.

DENVER SEWER PIPE & CLAY CO.
Denver, Colo.

Airport equipment: Drainage pipes.

DETROIT HARVESTER COMPANY
5450 W. Jefferson, Detroit, Mich.

C. A. Haefner, vice-president.

Airport equipment: Maintenance apparatus (mowers; snow removers).

DETROIT STEEL PRODUCTS COMPANY
2252 E. Grand Blvd., Detroit, Mich.

Airport equipment: Hangar doors.

THE DE VILBISS COMPANY
300 Phillips Ave., Toledo, Ohio

A. D. Gutchess, president; F. A. Bailey, vice-president and general manager; W. F. Gradolph, vice-president in charge of sales; R. A. Guyer, sales manager, spray equipment and compressor division.

Airport equipment: Paint sprayers. Air compressors.

C. A. DUNHAM COMPANY
450 E. Ohio, Chicago, Ill.

C. A. Dunham, president and treasurer; F. E. Schmidt, vice-president; C. M. Brigham, general sales manager.

Airport equipment: Hangar heaters.

DURABILT STEEL LOCKER COMPANY
453 Arnold Ave., Aurora, Ill.

Airport equipment: Lockers.

THE DURO METAL COMPANY
2649 N. Kildare, Chicago, Ill.

Airport equipment: Water filtration and purification apparatus.

E

ECLIPSE AVIATION CORP., E. Orange, N. J.

Charles Marcus, president; R. P. Lansing, vice-president; H. A. Gossner, secretary; W. J. Buettner, treasurer; C. H. Knoch, assistant secretary-treasurer; A. E. Raabe, sales manager and assistant secretary.

Factories: (foundry division) Little Falls, N. J.

Airport equipment: Engine starters (external energizer).

ELECTRIC MAGNETIC TOOL COMPANY
Chicago, Ill.

Airport equipment: Electric hand drills.

ERIE PUMP AND EQUIPMENT COMPANY
111 W. 11th St., Erie, Pa.

Airport equipment: Fuel pumps.

(*Continued on following pages*)

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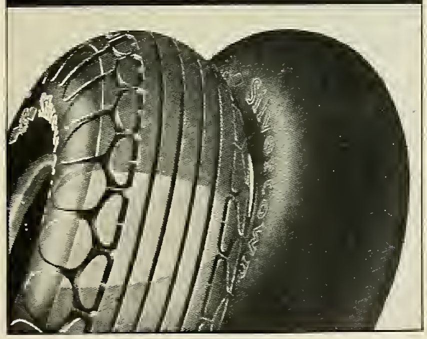

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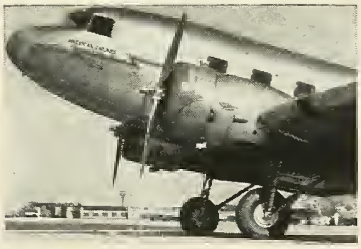

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Manufacturers of Airport Equipment and Products (Continued)

ESLINE COMPANY, Oconomowac, Wis.

Airport equipment: Hangars. Hangar doors.

ETHYL GASOLINE CORPORATION
135 E. 42nd St., New York, N. Y.

E. W. Webb, president; A. E. Mittnacht, secretary and treasurer; J. C. Taylor, sales manager.

Airport products: Petroleum (*Ethyl* gasoline).

THE EVERSMAN MANUFACTURING CO., INC.
453 Broadway, Denver, Colo.

Airport equipment: Maintenance apparatus (automatic land leveling machines).

F

GEORGE FAAT, Day St., Fitchburg, Mass.

Airport equipment: Wind socks.

FAIRBANKS, MORSE & COMPANY
900 S. Wabash Ave., Chicago, Ill.

Col. R. H. Morse, president and general manager; P. C. Brooks, vice-president; S. T. Kiddoo, vice-president and treasurer; A. C. Dodge, vice-president and general sales manager.

Airport equipment: Generators. Water pumps. Drill presses.

J. A. FAY & EGAN COMPANY
2860-2960 Robertson Ave., Cincinnati, Ohio

Airport equipment: Saws (band; buzz). Joiner. Shaper.

FEDERAL ELECTRIC CO., INC.
8700 S. State, Chicago, Ill.

Chas. Borland, president; W. D. Krupke, general sales manager.
Airport equipment: Sirens.

FISK BROTHERS REFINING COMPANY,
24 State Street, New York, N. Y.

F. J. Snyder, president; Wm. M. Teetsel, vice-president; C. Rodriguez, vice-president; F. W. Edwards, secretary-treasurer; Robert L. Watts, general manager, Lubriplate Division.

Factories: Newark, N. J.; Toledo, Ohio.
Airport products: Lubricants (*Lubriplate*).

FOREST ELECTRIC CO., Newark, N. J.

Airport equipment: Battery chargers.

J. P. FRIEZ AND SONS
Belford Observatory, Baltimore, Md.

Airport equipment: Weather recording instruments.

FYR FYTER COMPANY
454 Crane St., Dayton, Ohio
Airport equipment: Fire extinguishers.

G

GARDNER-DENVER CO., Quincy, Illinois.

R. H. Pearson, F. T. Wells, B. P. Spann.

Branch offices: Albany and New York, N. Y.; Atlanta, Ga.; Birmingham, Ala.; Boston, Mass.; Butte, Mont.; Charleston, W. Va.; Chicago, Ill.; Columbus, O.; Dallas, El Paso, Houston and Kilgore, Tex.; Denver, Colo.; Detroit, Mich.; Duluth, St. Paul and Minneapolis, Minn.; Kansas City and St. Louis, Mo.; Knoxville, Tenn.; Los Angeles and San Francisco, Calif.; Philadelphia, Pittsburgh, Pottsville and Scranton, Pa.; Portland, Ore.; Salt Lake City, Utah; Tulsa, Okla.; Wallace, Idaho; Washington, D.C.

Airport equipment: Air compressors.

GARLAND PRODUCTS COMPANY, INC.
2112 Washington Ave., St. Louis, Mo.

Airport products: Petroleum (*Luber-Tone* gasoline; oil).

GARRISON ENGINEERING CORP.,
Waterbury, Conn.

Branch offices: New York, N. Y.; Philadelphia, Pa.; Chicago, Ill.

Airport equipment: Fire extinguishers (*DuGas; Garfire* Gun).

GENERAL CABLE CORPORATION,
420 Lexington Ave., New York, N. Y.

Factories: Buffalo, N. Y.; Bayonne, N. J.; Emeryville, Calif.; Pawtucket, R. I.; Perth Amboy, N. J.; Rome, N. Y.; St. Louis, Mo.; Los Angeles, Calif.

Branch offices: Healey Bldg., Atlanta, Ga.; 89 Broad St., Boston, Mass.; 56 Clyde Ave., Buffalo, N. Y.; 20 Wacker Drive, Chicago, Ill.; Chamber of Commerce Bldg., Cincinnati, O.; 2637 Superior Ave., Cleveland, O.; Interurban Bldg., Dallas, Tex.; New Center Bldg., Detroit, Mich.; 3600 E. Olympic Blvd., Los Angeles, Calif.; 123 S. Broad St., Philadelphia, Pa.; Koppers Bldg., Pittsburgh, Pa.; Ambassador Bldg., St. Louis, Mo.; 1000 Mill St., Rome, N. Y.; 30 Otis St., San Francisco, Calif.; Smith Tower, Seattle, Wash.; 730-15th St., N.W., Washington, D.C.

Airport equipment: Cable and cable accessories (*Parkway; Trenchlay;* junction boxes; terminals, splicing material). Portable cord (jacketed *Thickol* and *Duprene*). Building wire. Welding cable. Combination landing light cable. Ignition cable. Lighting cable. Moulded ignition manifold. Magnet wire. Radio antenna wire. Starter and battery cable.

GENERAL ELECTRIC CO., Schenectady, N. Y.

J. C. Miller, manager, aeronautical section: H. C. Ritchie; E. G. Haven.
Airport equipment: Lights (flood; beacons; boundary; runway). Lighting lamps. Electric generators. Cable. Cable accessories. Battery chargers. Radio. Public address systems. Welding timers. Welders and welding accessories.

GENERAL FIREPROOFING COMPANY
308 E. Dennick Ave., Youngstown, Ohio

Airport equipment: Lockers.

THE GENERAL FIRE TRUCK CORPORATION
4127 Forest Park Blvd., St. Louis, Mo.

G. D. Kite, in charge of fire extinguisher division.
Airport equipment: Fire extinguishers (soda-acid; foam; carbon-tetrachloride).

GILBERT & BARKER MFG. CO.
Springfield, Mass.

Stanley C. Hope, president; P. H. Bills, vice-president and treasurer; K. S. Edwards, sales manager pump and tank division.

Airport equipment: Pumps (oil; fuel). Fuel systems.

GILMORE OIL COMPANY
2423 E. 28th St., Los Angeles, Calif.

E. B. Gilmore, president and general manager; C. S. Bessemyer, vice-president and treasurer; sales managers: W. G. Julier; J. L. Coates; B. A. Rowell; E. R. Williams.

Airport products: Surfacing material (*Roadamite* road oils and asphalt).

GLOBE AIR COMPRESSOR COMPANY
156 E. 42nd St., New York, N. Y.

Airport equipment: Air compressors.

GOULDS PUMPS, INC., Seneca Falls, N. Y.

Branch offices: Marietta St. Bldg., Atlanta, Ga.; 210 South St., Boston, Mass.; 53 W. Jackson Blvd., Chicago, Ill.; Shell Bldg., Houston, Tex.; 16 Murray St., New York, N. Y.; 111 N. Third St., Philadelphia, Pa.; Henry W. Oliver Bldg., Pittsburgh, Pa.; 213 E. Archer St., Tulsa, Okla.

Airport equipment: Pumps (water; sewage; sump). Oil purifiers (*Hydroil*).

GRAND ISLAND CULVERT & METAL WORKS
Grand Island, Neb.

Airport equipment: Wind tees.

HENRY J. GREEN,
1191 Bedford Ave., Brooklyn, N. Y.

Airport equipment: Meteorological instruments (barometers; barographs; anemometers; registers; wind vanes; psychrometers; thermometers, maximum, minimum, mercurial; hygrographs; hygro-thermographs).

GRINNEL BROS., INCORPORATED
239 Union Avenue, Brooklyn, N. Y.

Airport equipment: Hangar heaters. Sprinkler systems.

GULF REFINING COMPANY
Gulf Building, Pittsburgh, Pa.

J. Frank Drake, president; W. V. Hartman, vice-president; W. R. Huber, advertising and sales promotion manager. Aviation sales department: Major Alford Williams, manager; T. Harold "Doc" Kincaid, lubricating engineer.
Airport products: Petroleum (gasoline; *Gulfpride* oil).

H

HANCOCK TILE CO., Findlay, Ohio

Airport equipment: Drainage pipes.

HAUENSTEIN & BURMEISTER, INC.
Minneapolis, Minn.

Airport equipment. Hangars. Hangar doors.

(*Continued on following pages*)

DOUGLAS

MORE PAYLOAD FASTER AT LESS COST

Douglas Transports Score 7 Months Economy Record

SURPASSING anything heretofore experienced, Douglas equipped airlines in the United States report for the first seven months of 1935 vital decreases in operating expense over previous equipment. Item for item, the DC-2 average cost of operation is 29% less per passenger mile than equipment it replaced, yet its speed is approximately 100% faster.

Douglas Transports now fly 54,355 miles every day for U. S. airlines—27% of the total miles flown, although the 58 Douglas Transports in American service represent only 13% of the total number of airplanes in use.

This means an unparalleled revenue return in air transportation, as Douglas Transports are in the air an average of 6 hours, 19 minutes *every* day of the year. Douglas Aircraft Co., Inc., Santa Monica, Calif.

AROUND THE WORLD

Manufacturers of Airport Equipment and Products (Continued)

HAZARD INSULATED WIRE WORKS
Passaic, New Jersey

Factories: Wilkes-Barre, Pa.
Branch offices: Atlanta, Ga.; Boston, Mass.; Chicago, Ill.; Dallas, Tex.; Seattle, Wash.; St. Louis, Mo.; New York and Buffalo, N. Y.; Philadelphia and Pittsburgh, Pa.; San Francisco and Los Angeles, Calif.

Airport equipment: Electrical underground cable (*Armorite*).

HOBART BROS. CO., Troy, Ohio

E. C. Galbreath, general sales manager; C. K. Priest, advertising manager.
Airport equipment: Battery chargers.

HOFFMAN SPECIALTY CO., Waterbury, Conn.

Airport equipment: Valves. Pumps.

C. J. HOIGARD MANUFACTURING COMPANY
Minneapolis, Minn.

Airport equipment: Wind socks.

HOMESTEAD VALVE MANUFACTURING CO.,
Coraopolis, Pennsylvania

F. E. Schuchman, general manager.

Airport equipment: Cleaning machines (*Hypressure Jenny*).

HUMBLE OIL & REFINING COMPANY
Main & Polk, Houston, Texas

R. L. Blaffer, president and treasurer; H. C. Wiess, executive vice-president; F. O. Freese, secretary; Stuart A. Giraud, general sales manager.

Airport products: Petroleum (gasoline).

HUMPHREY CO., Kalamazoo, Mich.

F. A. Lemke, general sales manager.
Airport equipment: Hangar heaters.

I

IDEAL MANUFACTURING CO.
506 S.W. 2nd, Des Moines, Ia.

Ray F. Smith, president and sales manager.

Airport equipment: Mowers.

INGALLS IRON WORKS, Birmingham, Ala.

Airport equipment: Hangars. Hangar doors.

INGERSOLL-RAND CO., Chicago, Ill.

Airport equipment: Air compressors. Air pumps.

INTERNATIONAL HARVESTER CO. OF AMERICA, INC.
606 S. Michigan Ave., Chicago, Ill.

Sydney G. McAllister, president; Charles R. Morrison, vice-president and director of sales; J. L. McCaffrey, general sales manager.

Airport equipment: Tractors (*Formoll; McCormick-Deering*). Plows. Mowers. Levelers. Mowing units for tractors. Mower attachments.

INTERNATIONAL STEEL & IRON CO.
Evansville, Ind.

Airport equipment: Hangars.

INTERSTATE ELECTRIC CO., St. Louis, Mo.

Airport equipment: Battery chargers.

J

THE JAEGER MACHINE CO., Columbus, Ohio.

W. C. Best, manager signal division; C. S. Jones, eastern representative.
Branch offices: 280 Broadway, New York, N. Y.

Airport equipment: Lights (neon boundary; runway; obstruction). Buoys for night water landings.

JENSEN RADIO MANUFACTURING CO.
6601 S. Laramie Ave., Chicago, Ill.

Peter L. Jensen, president; A. Leslie Oliver, vice-president; Thos. A. White, general sales and export manager.

Airport equipment: Public address systems.

JOHNSON AIRPLANE & SUPPLY CO.,
Dayton, Ohio

E. A. Johnson, president.

Airport equipment: Wind socks. Fire extinguishers. Baggage trunks.

JOHNSON & JOHNSON, New Brunswick, N. J.

Branch offices: New Brunswick, N. J.; Chicago, Ill.

Airport equipment: First aid kits.

JOHNSON SERVICE COMPANY
507 E. Michigan, Milwaukee, Wisc.

H. W. Ellis, president and general manager; F. M. Ward, secretary and assistant treasurer.

Airport equipment: Thermo control system.

K

KELLOGG SWITCHBOARD & SUPPLY CO.
1066 W. Adams, Chicago, Ill.

G. A. Yanochowski, president; Seymour Guthrie, secretary and treasurer; H. E. Billington, general sales manager.
Airport equipment: Air compressors.

KENDALL REFINING CO., Bradford, Pa.

Airport products: Petroleum (*Kendall* oil; rocker arm lubricant; grease).

KERITE INSULATED WIRE & CABLE CO.
30 Church St., New York, N. Y.

Airport equipment: Cable.

KEWANEE BOILER CORPORATION
Franklin & "Q" Tracks, Kewanee, Ill.

Airport equipment: Hangar heaters.

WALTER KIDDIE & COMPANY,
140 Cedar Street, New York, N. Y.

Aeronautical sales managers: C. L. Griffin (New York); S. G. Freck (Chicago); Howard B. Teter (Cleveland).
Factory: Bloomfield, N. J.

Branch offices: Chicago, Ill; Cleveland, O.

Airport equipment: Fire extinguishers (*Lux* carbon dioxide).

KILLIFER MANUFACTURING CO., Peoria, Ill.

Airport equipment: Grading and surfacing material.

THE KOHLER COMPANY, Kohler, Wisc.

Airport equipment: Electric generators.

KOPPERS PRODUCTS COMPANY,
Koppers Bldg., Pittsburgh, Pa.

R. H. McClintic, advertising manager.
Airport equipment: Surfacting material.

KRAISSL COMPANY
23 Madison Ave., New York, N. Y.

Airport equipment: Fuel pumps.

L

LACLEDE-CHRISTY CLAY PRODUCTS CO.
411 N. 7th St., St. Louis, Mo.

John L. Green, president; W. J. Westphalen, vice-president and general manager; John H. McKelvey, vice-president in charge of sales; J. M. Baggot, secretary.

Branch offices: 4452 W. 5th Ave., Chicago, Ill.; 120 E. 41 St., New York, N. Y.

Airport equipment: Drainage (clay sewer pipe; segment blocks; drain tile).

LEIF LEE HEATING ENGINEERS
2637 Koppers Bldg., Pittsburgh, Pa.

Airport equipment: Hangar heaters.

LIGHTS, INCORPORATED
3508 Avalon Blvd., Los Angeles, Calif.

Airport equipment: Beacons.

LINCOLN STEEL & FORGE CO.
5701 Bridge Ave., St. Louis, Mo.

Airport equipment: Hangars.

LINCOLN STEEL WORKS
1941 Y Street, Lincoln, Nebr.

Airport equipment: Hangars.

LYON METAL PRODUCTS, INCORPORATED
Aurora, Ill.

F. B. Heitkamp, general sales manager.
Airport equipment: Lockers.

M

MAGNUS CHEMICAL COMPANY
South Ave., Garwood, N. J.

Airport equipment: Cleaning apparatus.

MARSHALLTOWN MANUFACTURING CO.
Marshalltown, Iowa

J. M. Considine, vice-president (Chicago).

Branch offices: 549 W. Randolph St., Chicago, Ill.
Airport equipment: Pressure gauges (air; oil; steam; water). Air filters.

MARTIN ELECTRIC COMPANY
San Antonio, Texas

Airport equipment: Lights (boundary; flood).

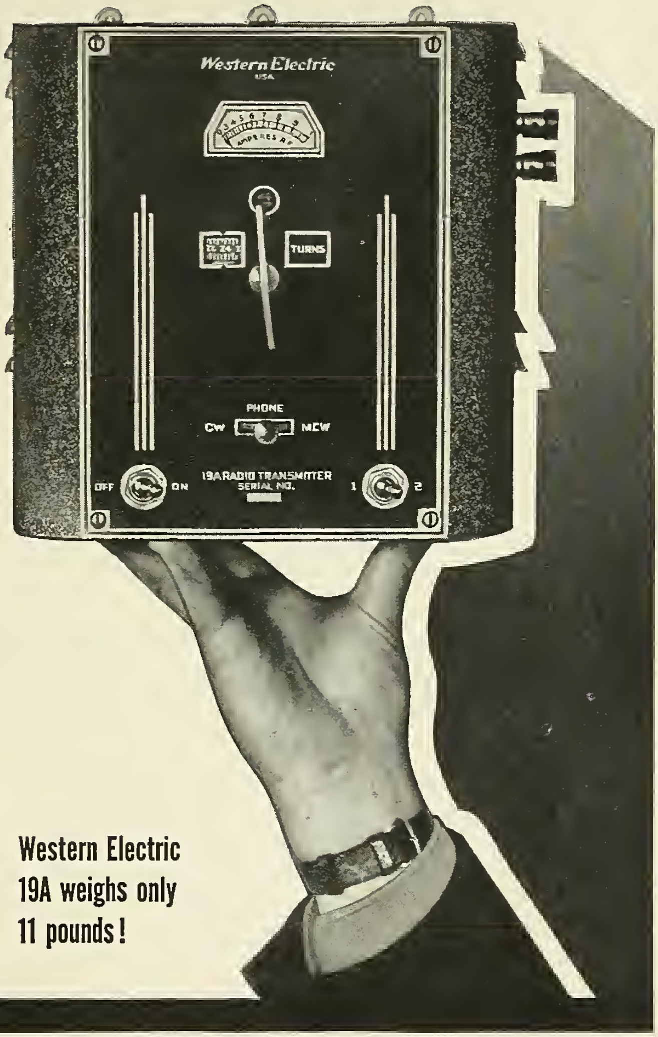
(*Continued on following pages*)

MIDGET TRANSMITTER

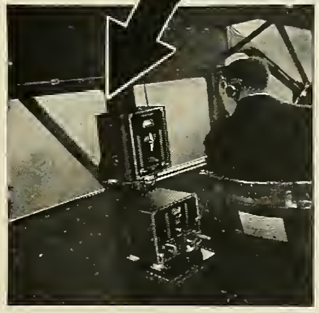
for Private Flyers!

It's got everything!

- ✓ Designed for *small* planes: made by Western Electric—test flown and reliable.
- ✓ Light weight: 11 pounds. Power supply, microphone, etc., add only 16 pounds.
- ✓ Small size: 8½″ x 9¼″ x 6½″. Antenna meter built-in.
- ✓ Three types of transmission: 100% modulated PHONE, CW and MCW—selected by switch.
- ✓ Easy to operate: single control (local or remote) and press-to-talk microphone.
- ✓ 2000 to 7000 KC—crystal stabilized.
- ✓ Quick shift from 3105 to 3120 KC to meet Federal Communications Commission order.
- ✓ Simple to install: all electrical connections through one plug. Shockproof mounting.
- ✓ Uses only two tubes: newest pentode type.
- ✓ Operates from 12 volt plane battery.
- ✓ Any type antenna. Built-in relay permits using same antenna for receiving.



Western Electric 19A weighs only 11 pounds!



For 2-way . . . add the Double Duty Receiver

Covers both Department of Commerce and broadcast bands—has special static reducer—weighs 11 pounds with tubes and mounting. Built to the same high standards as the Western Electric units on all the major airlines. Get full details from Western Electric Co., Dept. 296 AD, 195 Broadway, New York.

Western Electric *Northern Electric in Canada*

TWO-WAY AVIATION RADIO TELEPHONE AND TELEGRAPH EQUIPMENT

Manufacturers of Airport Equipment and Products (Continued)

MARYLAND METAL BUILDING CO.,
Baltimore, Md.

C. H. Michel, president (Baltimore); Owen C. Burgess, manager (New York); Eugene A. Simpson (Cumberland); John C. Brodt (Chicago); R. Massie Nolting (Richmond); O. C. Schlanbusch (Wilkes-Barre); A. E. Sortore (Avondale Estates).

Branch offices: 30 Church St., New York, N. Y.; 88 Broad St., Boston, Mass.; Jenvey Bldg., Cumberland, Md.; Builders Exchange Bldg., Richmond, Va.; 512 S. Canal St., Chicago, Ill.; Miners Bank Bldg., Wilkes-Barre, Pa.; 27 Dartmouth Ave., Avondale Estates, Ga.

Airport equipment: Hangars (metal).

THE MASSEY-HARRIS CO., Racine, Wisconsin.

E. F. Schiele, sales manager.
Factories: Batavia, N. Y.; Racine, Wisc.

Airport equipment: 4-Wheel Drive Tractors.

FRED MEDART MANUFACTURING COMPANY
Potomac & DeKalb, St. Louis, Mo.

Airport equipment: Lockers.

MERCURY MANUFACTURING CO.
Chicago, Ill.

Airport equipment: Tractors (*Banty-Quad*). Trucks (baggage, mail, express).

MINE SAFETY APPLIANCE CO.
Braddock, Thomas & Meade, Pittsburgh, Pa.

Airport equipment: First aid kits.

MISSISSIPPI VALLEY STRUCTURAL STEEL CO.
Decatur, Ill.

Airport equipment: Hangars.

S. S. MOSHER, Denver, Colo.

Airport equipment: Electrical cabinets.

MUSKOGEE IRON WORK, Muskogee, Okla.
Airport equipment: Hangars. Hangar doors.

THE F. E. MYERS & BRO. CO., Ashland, Ohio

Branch offices: Milwaukee, Wisc.; Cedar Rapids, Ia.; Harrisburg, Pa.; St. Louis, Mo.; Albany, N. Y.

Airport equipment: Pumps and pump accessories (power; water). Power cleaner apparatus. Hangar door accessories (roller bearings; tracks).

N

NASH ENGINEERING CO., S. Norwalk, Conn.

Airport equipment: Water pumps.

NATIONAL COMPANY, Inc., Malden, Mass.

Airport equipment: Radio.

NEBRASKA CULVERT & MFG. CO.
Wahoo, Nebraska

Airport equipment: Drainage pipes.

HERMAN NELSON CORPORATION
1834 Third Ave., Moline, Ill.

Robert Nelson, general sales manager.
Airport equipment: Hangar heaters (*Univent*).

NEWPORT ROLLING MILL CO.
9th & Lowell Sts., Newport, Ky.

Airport equipment: Drainage pipes.

NICHOLS PRODUCTS CORPORATION
12953 Greeley Ave., Detroit, Mich.

Airport equipment: Oil burner.

O

OAKITE PRODUCTS, INC.
23 Thames St., New York, N. Y.

Airport equipment: Cleaning apparatus.

OCS MANUFACTURING COMPANY
Coffeyville, Kans.

Airport equipment: Lockers. Dollies. Wind socks.

OPERADIO MANUFACTURING COMPANY
St. Charles, Ill.

J. McWilliams Stone, president and advertising manager; Laurence A. King, secretary and treasurer in charge of sales.

Airport equipment: Public address systems.

ORANGE CAR & STEEL COMPANY
Orange, Texas

Airport equipment: Hangars. Hangar doors.

KARL ORT, York, Pennsylvania.

Karl Ort, president.

Airport equipment: Wind cones. Wind tees. Trucks (baggage; service). Wheel chocks.

P

PASS & SEYMOUR, INC., Solvay, N. Y.

Airport equipment: Switches (*Despard*).

PECK, STOW & WILCOX COMPANY
Southington, Conn.

Airport equipment: Shears (*Pexto*).

PECCO, INC., St. Louis, Mo.

Airport equipment: Hangar heaters.

PENN METAL CO. OF PENNSYLVANIA
Oregon Ave. & Swanson St., Philadelphia, Pa.

Airport equipment: Lockers.

THE PENNZOIL COMPANY
Drake Theatre Bldg., Oil City, Pa.

C. L. Suhr, president; J. F. Vandeventer, executive vice-president; D. J. Cavanaugh, secretary; M. A. Brewster, treasurer; W. S. Zehrung, general manager; B. S. Phillips, sales manager.
Airport products: Petroleum (gasoline; oil).

PORTLAND CEMENT ASSOCIATION
33 West Grand Ave., Chicago, Ill.

Charles A. Clark, assistant manager, highways and municipal bureau (Chicago); H. J. Young, acting district engineer (Lincoln); H. R. Albion, southeastern manager (Atlanta); C. D. Franks, midwestern manager (Chicago); M. J. McMillan, acting manager (Washington); district engineers: T. B. Warden (Austin); W. H. Steiner (Des Moines); H. J. McDargh (Indianapolis); F. S. Altman (Minneapolis); R. W. Winters (Oklahoma City); G. C. Britton (Philadelphia); J. E. Jellick (San Francisco); H. E. Frech (St. Louis); district managers: M. H. Small (Kansas City); Amos H. Potts (Los Angeles); F. M. Fleming (New York); F. J. Barrett (Seattle).

Branch offices: Hurt Bldg., Atlanta, Ga.; 1301 Norwood Bldg., Austin, Tex.; 33 West Grand Ave., Chicago, Ill.; 408 Hubbell Bldg., Des Moines, Iowa; 610 Merchants' Bank Bldg., Indianapolis, Ind.; Gloyd Bldg., Kansas City, Mo.; 321 Terminal Bldg., Lincoln, Nebr.; 816 W. Fifth St., Los Angeles, Calif.; 802 Baker Bldg., Minneapolis, Minn.; 347 Madison Ave., New York, N. Y.; 1421 First National Bldg., Oklahoma City, Okla.; 1528 Walnut St., Philadelphia, Pa.; 564 Market St., San Francisco, Calif.; 903 Seaboard Bldg., Seattle, Wash.; 1412 Syndicate Trust Bldg., St. Louis, Mo.; 837 National Press Bldg., Washington, D. C.

Airport equipment: Cement.

PHILCO RADIO AND TELEVISION CORP.
C & Tioga Sts., Philadelphia, Pa.

Larry E. Gubb, president and general sales manager; Sayre M. Ramsdell, vice-president and sales promotion manager; R. L. Heberling, vice-president; Howard McDaniel, secretary.

Airport equipment: Radios.

PHILLIPS PETROLEUM CO., Bartlesville, Okla.

Frank Phillips, president; H. A. Trower, vice-president in charge of sales; O. K. King, treasurer; A. M. Hughes, sales manager.

Airport products: Petroleum (*Phillips 66* gasoline; oil).

THE PHISTER MANUFACTURING COMPANY,
621 E. Pearl St., Cincinnati, Ohio.

Kirby D. Frisby, eastern sales and export manager.

Branch offices: 30 Church St., New York, N. Y.; 53 W. Jackson Blvd., Chicago, Ill.

Airport equipment: Fire extinguishers (*Phister* carbon tetrachloride).

POMONA PUMP COMPANY
206 E. Commercial St., Pomona, Calif.

Airport equipment: Water pumps.

THE PUMP ENGINEERING SERVICE CORP.
3015 E. 61st St., Cleveland, Ohio

William R. Jack, president.

Airport equipment: Fuel pumps.

THE PURE OIL CO., Chicago, Ill.

Major D. H. Young, manager, aviation department (Columbus); James J. Mattern, technical aeronautical advisor (Chicago).

Refineries: Marcus Hook, Pa.; Cabin Creek Jct., W. Va.; Heath, O.; Muskogee, Okla.; Smith's Bluff, Tex.; Toledo, O.; Midland, Mich.

(*Continued on following pages*)

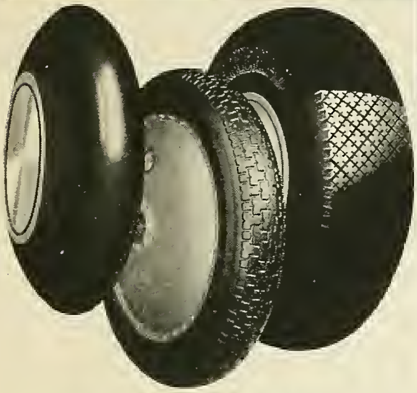
AVIATION'S FAMOUS DESIGNERS use *Streamlines*

★ AMERICAN GIRO COMPANY
★ NORTHROP AIRCRAFT CORP.
★ BEECH AIRCRAFT COMPANY
★ BELLANCA AIRCRAFT CORP.
★ SEVERSKY AIRCRAFT CORP.
★ CHANCE VOUGHT CORPORATION
★ SIKORSKY AVIATION CORP.
★ KINNER AIRPLANE COMPANY
★ WALDO WATTERMAN
★ STEARMAN AIRCRAFT COMPANY
★ PENNSYLVANIA AIR LINES
★ LOCKHEED AIRCRAFT CORP.
★ CESSNA AIRCRAFT COMPANY

FAMOUS PILOTS USE *Streamlines*

★ DOOLITTLE
★ TURNER
★ BILLY PARKER
★ RAY SHRADER
★ TOM COLBY

IF IT'S *streamline* - IT'S A GENERAL



MAKE YOUR SELECTION FROM GENERAL'S COMPLETE AIRPLANE LINE

● The revolutionary Streamline tire, originated and perfected by General, is the latest development in airplane tire efficiency. Streamline tires are standard equipment on Army planes and widely used by the Navy.

Whatever your individual requirements may be, General builds a tire to fit the job. General's High Pressure and Intermediate tires represent the utmost in safety and long service for these types of tires. Correspondence regarding your tire problems is invited.

AIR ASSOCIATES
NEW YORK, CHICAGO
LOS ANGELES

BREDOUW-HILLIARD
AEROMOTIVE SERVICE
KANSAS CITY, MO.

GENERAL TIRE & RUBBER CO.
AKRON, OHIO

Principal offices: Chicago, Ill.; New York, N. Y.; Philadelphia and Pittsburgh, Pa.; Trenton, N. J.; Columbus, O.; Norfolk, Va.; Atlanta, Ga.; Minneapolis, Minn.; Des Moines, Ia.; Tulsa, Okla.; Beaumont, Tex.

Airport products: Petroleum (*Tiolene* motor oil; rocker arm grease; *Purol* gasoline.)

THE PYLE-NATIONAL CO., Chicago, Ill.

Jack Vilas, manager, aviation department; C. E. Nelson, aviation department. Branch offices: Grand Central Terminal, New York, N. Y.; Boatmen's Bank Bldg., St. Louis, Mo.; Builders Exchange Bldg., St. Paul, Minn.; Hobart Bldg., San Francisco, Calif.

Airport equipment: Wind tees. Lighting (floodlights; beacons; flashers; course lights; traffic signals; ceiling and floodlight projectors; markers; obstruction; boundary). Gasoline electric plants. Lighting accessories (light fixtures; globes; cable connection boxes; relief bushings; fittings; globe guards).

PYRENE MANUFACTURING COMPANY
560 Belmont Ave., Newark, N. J.

E. A. Clapp, president; E. J. Waring, vice-president; E. G. Weed, vice-president in charge of sales and advertising. Airport equipment: Fire extinguishers.

PYROIL CO., 122 Main, La Crosse, Wis.

D. L. Kidder, president; T. B. Gantenbein, secretary, treasurer, general manager and purchasing agent. Airport products: Petroleum (*Pyroil* gasoline; oil).

Q

QUAKER STATE OIL REFINING CO.
Chambers Bldg., Oil City, Pa.

S. Messer, president; J. D. Berry, vice-president; J. M. Koch, vice-president and general sales manager.

Airport products: Petroleum (*Quaker State* oil; grease).

QUALLS ELECTRIC COMPANY,
212 E. Wayne St., South Bend, Ind.

Wm. F. Qualls, president; Wm. F. Qualls, 2nd, vice-president; H. N. Qualls, secretary-terasurer.

Airport equipment: Wind tees.

R

RCA MANUFACTURING COMPANY, INC.,
Camden, N. J.

David S. Little, manager aviation radio section; Hugh E. Allen, chief aviation engineer; Robert S. Van Cleve, engineer. Field engineers, A. M. Harned (Camden); G. G. Covey (Cleveland).

Airport equipment: Traffic control transmitters. Linear amplifiers. Radio beacon attachments. Receivers. Public address systems.

RAD-I-CONE MANUFACTURING CO.
Milwaukee, Wis.

Airport equipment: Wind tees.

RADIO NAVIGATIONAL INSTRUMENT CO.
22 E. 40th St., New York, N. Y.

Airport equipment: Directional radio guide.

REMINGTON-RAND, INCORPORATED
465 Washington, Buffalo, N. Y.

Airport equipment: Air compressors. Air pumps.

REMLER COMPANY, LTD.
2101 Bryant St., San Francisco, Calif.

F. G. Hawkinson, sales manager; R. B. Walder, chief engineer.

Airport equipment: Amplifiers. Microphones. Speakers. Audio frequency accessories.

RICHARDS-WILCOX, Aurora, Ill.

W. H. Fitch, president and general manager; Lee Mighell, vice-president; M. D. Jones, secretary-treasurer; P. L. Hoffman, superintendent.

Branch offices: New York, N. Y.; Chicago, Ill.; Philadelphia, Pa.; Boston, Mass.; St. Louis, Mo.; Minneapolis, Minn.; San Francisco and Los Angeles, Calif.; Indianapolis, Ind.; Cleveland and Cincinnati, Ohio; Kansas City, Mo.; Seattle, Wash.; Omaha, Neb.; Detroit, Mich.; New Orleans, La.; Des Moines, Ia.; Milwaukee, Wisc.; Atlanta, Ga.

Airport equipment: Hangar doors and hangar door equipment.

RICHFIELD OIL CO. OF CALIFORNIA
555 S. Flower, Los Angeles, Calif.

Wm. C. McDuffie, receiver in equity; R. W. Walsh, sales manager.

Airport products: Petroleum (gasoline; oil).

W. A. RIDDELL COMPANY
South Walnut, Bucyrus, Ohio

N. E. Jersey, sales manager, road machinery.

Airport equipment: Grading apparatus (roller).

ROANOKE BRIDGE & IRON WORKS
Roanoke, Va.

Airport equipment: Hangars. Hangar doors.

ROBBINS & MYERS, INCORPORATED
1345 Lagonda Ave., Springfield, Ohio

C. H. Clark, general sales manager. Airport equipment: Sirens.

JOHN A. ROEBLING'S SONS CO.
640 S. Broad, Trenton, N. J.

F. W. Roebling, Jr., president; W. A. Anderson, vice-president, treasurer and general manager; A. C. Cooley, secretary; C. C. Cooley, general sales manager.

Factories: Trenton and Roebling, N. J. Branch offices: 107 Liberty St., New York, N. Y.; 51 Sleeper St., Boston, Mass.; 205 W. Wacker Drive, Chicago, Ill.; 223 Arch St., Philadelphia, Pa.; 701 St. Claire Ave., N.E., Cleveland, O.; 934 Avon Ave., Atlanta, Ga. John A. Roebling's Sons Co. of California; 624 Folsom St., San Francisco, Calif.; 216 S. Alameda St., Los Angeles, Calif.; 1032 N.W. 14 Ave., Portland, Ore.; 900 First Ave., S., Seattle, Wash.

Airport equipment: Wire and wire rope. Insulated wire and cable. Wire rope fittings and slings. Electric or gas welding wire. Serving and locking wire. Wire. Controls casing, cord and strand.

GEO. D. ROPER CORP., Rockford, Ill.

Branch offices: 8 S. Michigan Ave., Chicago, Ill.

Airport equipment: Pumps (oil; tank trucks).

RUSSELL GRADER MANUFACTURING CO.
2005 University Ave., Minneapolis, Minn.

Airport equipment: Grading and maintenance apparatus.

S

SEABURY & JOHNSON
222 Fourth Ave., New York, N. Y.

Airport equipment: First aid kits.

SHARPSVILLE BOILER WORKS CO.
Sharpsville, Pa.

Airport equipment: Fuel pumps.

SHAW-WALKER CO., Muskegon, Mich.

Airport equipment: Lockers.

SHELL PETROLEUM CORPORATION
Shell Bldg., St. Louis, Mo.

Major James H. Doolittle, aviation manager; Rex Brashear, assistant manager; Jimmy Haizlip, in charge of flying activities; E. Zimmerman, manager of technical department (St. Louis). M. Hamon, manager of aviation sales; J. Bouma, assistant manager (New York). Robert Adamson, manager, aviation sales; Ray Moore, assistant manager (San Francisco).

Branch offices: Shell Eastern Petroleum Products, Inc., 50 W. 50 St., New York, N. Y.; Shell Oil Co., Shell Bldg., San Francisco, Calif.

Airport products: Petroleum (*Shell* gasoline; oil; rocker arm lubricants).

SINCLAIR REFINING COMPANY
45 Nassau St., New York, N. Y.

E. W. Sinclair, president; J. W. Carnes, sales manager.

Airport products: Petroleum (gasoline; oil).

SKELLY OIL COMPANY
2534 Madison, Kansas City, Mo.

W. G. Skelly, president; C. C. Herndon, executive vice-president; F. T. Hopp, secretary and treasurer.

Airport products: Petroleum (*Skelgas* gasoline).

SKINNER BROS. MFG. CO., INC.
1488 S. Vandeventer Ave., St. Louis, Mo.

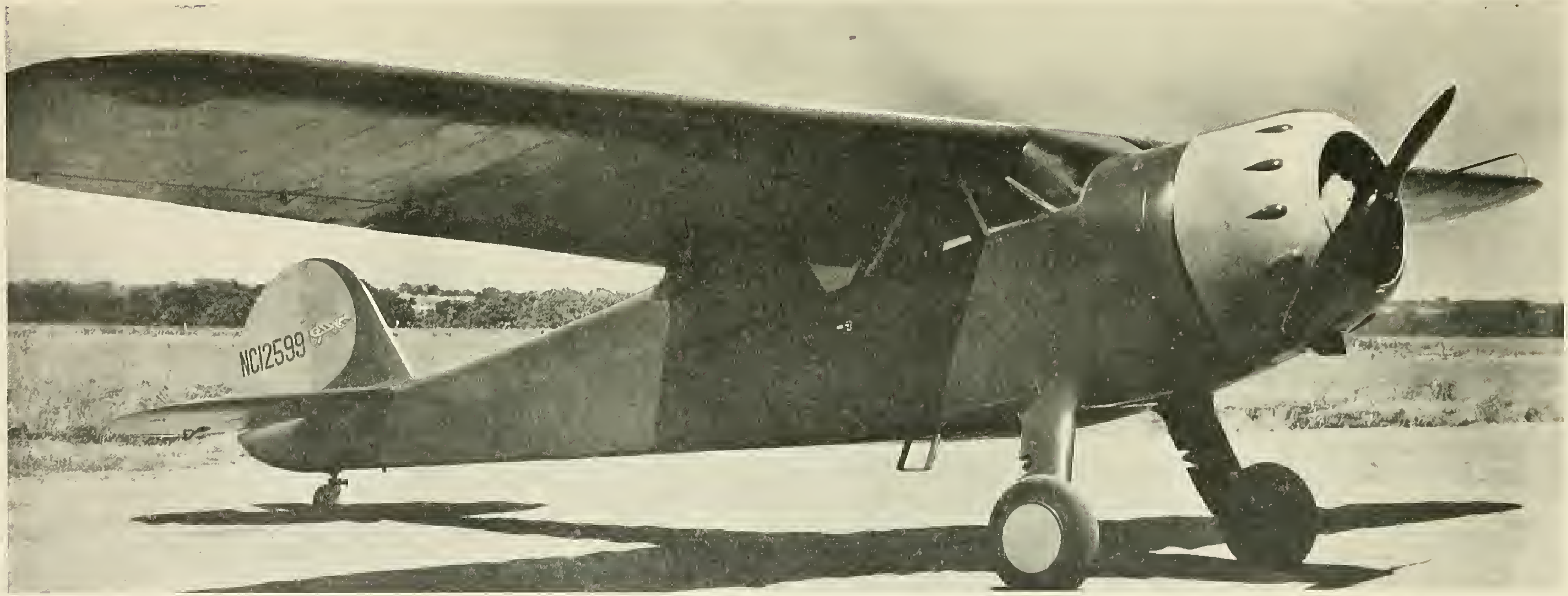
Airport equipment: Hangar heaters.

SMITH ACETYLENE & WELDING EQUIPMENT
Minneapolis, Minn.

Airport equipment: Welding apparatus.

(*Continued on following pages*)

Congratulations › › CESSNA C34



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WELLINGTON SEARS CO.
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WARNER AIRCRAFT CORP.
Detroit, Michigan

NICHOLAS-BEAZLEY AIRPLANE CO.
Marshall, Mo.

OHIO SEAMLESS TUBE CO.
Shelby, Ohio

AIR ASSOCIATES, INC.
Chicago, Illinois

PITTSBURGH PLATE GLASS CO.
Pittsburgh, Pa.

HAYES INDUSTRIES, INC.
Jackson, Michigan

HARTZELL PROPELLER CO.
Piqua, Ohio

AIRCRAFT STEEL & SUPPLY CO.
Wichita, Kansas

GENERAL TIRE & RUBBER CO.
Akron, Ohio

Manufacturers of Airport Equipment and Products (Continued)

SNAP-ON COMPANY, INC. Milwaukee, Wis.
Airport equipment: Socket wrenches.

SOCONY-VACUUM OIL CO., INC.,
26 Broadway, New York, N. Y.
W. L. Faust, general sales; Col. H. W. Lake, domestic sales manager; G. B. Patterson, technical assistant manager; L. A. McVey, advertising manager; H. F. Tarbox, office manager; J. S. Dexter, eastern division manager.

Airport products: Petroleum (*Aero Mobiloil;* oil).

SOUTH BEND LATHE WORKS
423 E. Madison St., South Bend, Ind.
Airport equipment: Lathes.

SPERRY GYROSCOPE CO., Brooklyn, N. Y.
C. D. Jobson, manager, aeronautical department; L. N. Swisher, superintendent, service department; D. L. Garber, instructor, aeronautical school; Leslie F. Carter, instrument engineer; B. G. Carlson, gyropilot engineer; Stevin J. Zand, acoustical engineer; W. I. Selover (Los Angeles); H. S. Burtis (Seattle); J. F. McConkey (San Francisco).

Branch offices: 58 Main St., San Francisco, Calif.; 2737 First Ave., S., Seattle, Wash.; 1316 W. G St., Wilmington, Calif.

Airport equipment: High intensity arc floodlights (*Sperry; AGA; BBT*).

STANAVO SPECIFICATION BOARD, INC.
26 Broadway, New York, N. Y.
Maj. E. E. Aldrin, vice-president and director; S. Dudley, secretary; D. C. Jennings, director; R. P. Resor, treasurer (New York); S. S. Chadderton, vice-president and director; J. H. Terry, director (San Francisco); J. B. Porter, vice-president and director; R. E. Wilken, director (Chicago).

Branch offices: 910 S. Michigan Ave., Chicago, Ill.; 225 Bush St., San Francisco, Calif. Distributors: Colonial Beacon Oil Co., Inc., Boston, Mass.; Humble Oil & Refining Co., Houston, Tex.; Pasotex Oil Co., El Paso, Tex.; Standard Oil Co. (Ohio), Cleveland; Standard Oil Co. of California, San Francisco: Standard Oil Co. (Indiana) Chicago, Ill.; Standard Oil Co. (Kentucky) Louisville; Standard Oil Co. of Louisiana, New Orleans; Standard Oil Co. of Nebraska, Omaha; Standard Oil Co. of New Jersey, New York, N. Y.; Standard Oil Co. of Pennsylvania, Philadelphia.

Airport products: Petroleum (*Stanavo* gasoline; oil; rocker arm grease; instrument oil).

STANDARD FENCE CO., Oakland, Calif.
Airport equipment: Fencing.

STEFCO STEEL CO., Michigan City, Ind.
Airport equipment: Hangars. Hangar doors.

STEMPEL FIRE EXTINGUISHER MFG. CO.
20th & Ferry Sts., St. Louis, Mo.
Airport equipment: Fire extinguishers (soda-acid; foam; carbon-tetrachloride; calcium-chloride).

STERLING SIREN FIRE ALARM CO., INC.
Rochester, N. Y.
Airport equipment: Sirens.

STEWART IRON WORKS, CO., INC.
17th & Madison Ave., Covington, Ky.
Airport equipment: Fencing.

SULLIVAN MACHINERY CO., Chicago, Ill.
Airport equipment: Air compressor.

T

TAYLOR INSTRUMENT COMPANIES
Ames & West Ave., Rochester, N. Y.
H. J. Winn, president and treasurer; H. W. Kimmel, secretary; P. R. Jameson, director of sales; sales managers: F. K. Taylor; W. M. Griffith.

Airport equipment: Instruments (barometer; thermometer; anemometer).

TERRELLS EQUIPMENT COMPANY
Grand Rapids, Mich.
Airport equipment: Lockers.

THE TEXAS CO., 135 E. 42 St., N. Y., N. Y.
J. D. Jernigin, Jr., manager, aviation sales; P. J. Clausen, aviation engineer; C. E. Stuart, chief clerk. Aviation representatives: R. J. Hall (Chicago), H. P. Henning (Dallas), Aubrey Keif, (New York, N. Y.).

Branch offices: Boston, Mass.; New York, N. Y.; Norfolk, Va.; Indianapolis, Ind.; Chicago, Ill.; Minneapolis, Minn.; Denver, Colo.; Atlanta, Ga.; Dallas and Houston, Tex.; New Orleans, La.; Los Angeles, Calif.; Seattle, Wash.; Butte, Mont.

Airport products: Petroleum (*Texaco* oil; gasoline; *Marfak* rocker arm grease). Asphalt products (runways; hangar floors; aprons; dust laying).

TOKHEIM OIL TANK & PUMP COMPANY
Wabash Ave., Ft. Wayne, Ind.
Airport equipment: Pumps (fuel; oil; air).

TORO MANUFACTURING COMPANY
3042 Snelling Ave., Minneapolis, Minn.
J. S. Clapper, president; H. C. McCartney, secretary and treasurer.

Airport equipment: Tractors. Mowing machinery.

JAMES H. TOWER IRON WORKS
50 Borden, Providence, R. I.
Airport equipment: Rollers.

THE TRANE COMPANY
2nd & Cameron Ave., LaCrosse, Wis.
Airport equipment: Hangar heaters.

TRIPLE A SPECIALTY CO., Chicago, Ill.
Airport equipment: Battery chargers (*Silver Beauty*).

TRUSCON STEEL CO., Youngstown, Ohio
Airport equipment: Hangars. Hangar doors.

C. H. TULLY FENCE CO., Grand Island, Neb.
Airport equipment: Fencing.

U

THE U. S. AIR COMPRESSOR CO.
5300 Howard Ave., Cleveland, Ohio
R. L. Bacher, president; W. C. Smith, vice-president, secretary and general manager; K. S. Clapp, director of sales; Leo Spalding, sales manager.

Airport equipment: Air compressors. Air pumps.

U. S. ELECTRICAL TOOL CO., Cicinnati, Ohio
Airport equipment: Electric hand drills.

UNIVERSAL MICROPHONE COMPANY
424 Warren Lane, Inglewood, Calif.
Airport equipment: Public address systems.

V

VALLEY ELECTRIC CO., St. Louis, Mo.
Airport equipment: Battery chargers. Portable starters.

VIKING CORPORATION, Hastings, Mich.
Airport equipment: Sprinkler system.

VIKING PUMP CO., Cedar Falls, Iowa.
C. F. Mullens, sales manager (Cedar Falls); district managers: C. W. Dennis (Chicago); J. A. Sinden (Cleveland); E. E. Burton (Los Angeles); H. H. Haight (Milwaukee); F. J. Wyth (Minneapolis); Herbert Fuhrer (New York); Warner Lewis (Tulsa).

Branch offices: 549 W. Washington Blvd., Chicago, Ill.; Marshall Bldg., Cleveland, Ohio; 2039 S. Santa Fe Ave., Los Angeles, Calif.; 2310 W. Vliet St., Milwaukee, Wisc.; Metropolitan Life Bldg., Minneapolis, Minn.; 342 Madison Ave., New York, N. Y.; 1424 S. Boston Ave., Tulsa, Okla.

Airport equipment: Pumps (*Viking*).

VIRGINIA BRIDGE & IRON CO., Roanoke, Va.
B. L. Sneed, vice-president.
Factories: Roanoke, Va.; Birmingham, Ala.; Memphis, Tenn.
Branch offices: New York, N. Y.; Atlanta, Ga.; Austin and El Paso, Tex.; Los Angeles, Calif.; Portland, Ore.
Airport equipment: Hangars.

W

WAGNER STEAM PUMP CO., Canton, Ohio
Airport equipment: Water pumps.

WALKER CEMENT PRODUCTS, INC.
Little Ferry, New Jersey
C. W. Cade, drainage engineer.

Airport equipment: Drainage systems (*Poroswall*).

WARNER-QUINLAN COMPANY
2 Park Avenue, New York, N. Y.
Airport equipment: Surfacing material.

WARREN TELECHRON CO., Ashland, Mass.
H. E. Warren, president; R. M. Mitchell, secretary & treasurer; C. E. Davis, general sales manager; I. W. Kokins, general manager.

Airport equipment: Clocks (*Telechron*).

WAYNE COMPANY, Ft. Wayne, Ind.
Airport equipment: Fuel pumps.

WEAVER MFG. CO., Springeld, Ill.
Airport equipment: Presses.

WEIDENHOFF MGF. CO., Chicago, Ill.
Airport equipment: Battery chargers.

(*Concluded on following page*)

Try a Waco — *and* you'll Fly a Waco

— AND YOU NEED PAY ONLY $5225 FOR IT!

Fifteen minutes in any of the four 1935 Model WACOs will show you why WACO is the choice of experienced pilots everywhere. And why hundreds of users have put their stamp of approval on WACO.

Each model is truly an engineering triumph—built and powered to out-perform anything in its class.

1935 WACOs give their purchasers flight security, economy, cruising comfort, all at the price of ordinary equipment.

No wonder WACO outsells every other make of aircraft—has won fame not only in America, but in 27 foreign countries, too.

Model illustrated is the new WACO standard plane.

Other world-famed WACO models include the F-6—priced from $6,530 to $8,825; the Custom Cabin ship at $6,630 to $8,675, and the beautiful Model D with a price range from $13,345 to $16,100. Get all the facts about the world's most popular airplane from the nearest WACO dealer. Or write direct.

★ ★ ★

SPECIFICATIONS AND GUARANTEED PERFORMANCE OF WACO STANDARD CABIN PLANE

Engine	Horse-power	Ignition	Top Speed	Cruising Speed	Landing Speed	Price
Continental	210	Magneto	140	122	50	$5,225.00
Jacobs	225	Magneto or Battery	144	125	50	5,490.00
Wright	250	Magneto	148	127	52	7,000.00

THE WACO AIRCRAFT COMPANY, TROY, OHIO

WACO AIRPLANES
"ASK ANY PILOT"
WACO LEADS IN AIRCRAFT REGISTRATION

Manufacturers of Airport Equipment and Products

WESTCO PUMP CORPORATION
Front & Gaines Sts., Davenport, Iowa

F. S. Main, general sales manager and advertising manager.

Airport equipment: Water pump.

WESTERN ELECTRIC CO.,
195 Broadway, New York, N. Y.

H. E. Young, general commercial engineer; E. W. Thurston, distributor sales engineer; H. N. Willetts, radio sales engineer; and aviation radio specialists: F. C. McMullen, D. R. Husted and A. E. Brundage.

Factories: Kearney, N. J.; Chicago, Ill.; Baltimore, Md.

Airport equipment: Radio receivers and transmitters. Public address systems. Interphone apparatus.

WESTERN PIPE & STEEL CO., Bakersfield, Calif.

Airport equipment: Hangars. Hangar doors.

WESTINGHOUSE ELECTRIC & MFG. CO.
East Pittsburgh, Penna.

Factories: East Pittsburgh, Pa.; Attica, N. Y.; Chicopee Falls, Mass.; Cleveland, O.; Derry, Pa.; East Springfield, Mass.; Emeryville, Calif.; Mansfield, O.; Newark, N. J.; Pittsburgh, Pa.; St. Louis, Mo.; Sharon and South Philadelphia, Pa.

Branch offices: Phoenix, Ariz.; Los Angeles, Oakland, San Francisco, Calif.; New Haven, Conn.; Wilmington, Del.; Washington, D. C.; Jacksonville, Tampa, Fla.; Atlanta, Ga.; Chicago, Peoria, Ill.; Evansville, Indianapolis, Ind.; Des Moines, Sioux City, Waterloo, Ia.; Wichita, Kans.; Augusta, Bangor, Me.; Baltimore, Md.; Boston, Springfield, Worcester, Mass.; Flint, Detroit, Grand Rapids, Mich.; Duluth, Minneapolis, St. Paul, Minn.; St. Louis, Mo.; Butte, Mont.; Omaha, Neb.; Newark, Trenton, N. J.; Albany, Binghamton, New York, Rochester, Syracuse, Utica, N. Y.; Charlotte, Raleigh, N. C.; Cleveland, Toledo, O.; Oklahoma City, Tulsa, Okla.; Portland, Ore.; Allentown, Philadelphia, Reading, York, Pa.; Providence, R. I.; Columbia, Greenville, S. C.; Memphis, Tenn.; Burlington, Vt.; Richmond, Va.; Dallas, Ft. Worth, Houston, San Antonio, Tex.; Seattle, Spokane, Wash.; Madison, Wisc.

Airport equipment: Radio power dynamotors. Electrically-operated fuel valves. Landing light lamps. *Nofuse* panel boards. Radio receivers and transmitters. Sentinel breakers. Airport and airway equipment (alidades; beacons; ceiling projectors; code flashers; floodlights, ornamental, landing field, hangar, fresnel; beacon lamps; marker cones and lights; Neon obstruction lights; on-course lights; searchlights; traffic signals; wind indicators). Electrical generators.

WESTON ELECTRICAL INSTRUMENT CO.
614 Frelinghuysen Ave., Newark, N. J.

E. F. Weston, president; Caxton Brown, vice-president and secretary; Earl R. Mellen, treasurer; H. D. Gerstenberger, sales manager.

Airport equipment: Instruments.

WHEELER BRIDGE & LBR.
Hubbell Bldg., Des Moines, Iowa

Airport equipment: Drainage pipes.

WHITE STAR REFINING CO.
Avery & Grand Truke Ry., Detroit, Mich.

Airport products: Petroleum (gasoline; oil).

WISSLER INSTRUMENT CO., St. Louis, Mo.

Airport equipment: Clinometer.

WOLVERINE EMPIRE REFINING CO.
51 Madison Ave., New York, N. Y.

C. H. Ellingwood, president; A. W. Scott, vice-president; F. W. Baer, secretary-treasurer; H. Landsberger, Jr., sales manager.

Airport products: Petroleum (*Wolf's Head* oil).

WORTHINGTON PUMP & MACHINERY CORP.
2 Park Avenue, New York, N. Y.

Factory: Harrison, New Jersey.
Airport equipment: Water pumps.

Y

YORK HEATING & VENTILATING CORP.
Philadelphia, Pa.

Airport equipment: Hangar heaters.

Z

ZENITH RADIO CORP., 3620 Iron, Chicago, Ill.

E. A. Tracey, general sales manager.
Airport equipment: Radios.

Airport Data Supplied By Bureau of Air Commerce

● The Bureau of Air Commerce collects and disseminates information describing airports and landing fields, the federal airways, Department of Commerce intermediate landing fields, general meteorological conditions, aeronautic radio facilities, special warnings, and other data essential to air navigation and the safety of flight.

Two airway bulletins have been published and revised at intervals. No. 1, *General Airway Information,* contains basic information pertaining to all federal air navigation facilities, such as locations and schedules of operation of Department of Commerce radio communication and radio range beacon stations, locations of beacon lights and intermediate landing fields, general meteorological summaries for the 48 States, and locations of weather-reporting stations.

The second bulletin, *Description of Airports and Landing Fields in the United States,* contains descriptions of all airports and landing fields in the United States of record with the Department, arranged alphabetically by states. These descriptions are of sufficient detail so that airmen will be able to locate the airport and also have knowledge in advance as to the size and shape of the landing area, the general condition of the field proper, radio and night lighting equipment in operation, and facilities available for servicing aircraft.

In addition to the full data which this section procures and records on all recognized airports and landing fields for inclusion in these two airway bulletins, a tabulation of emergency landing fields that may be used on occasion when for one reason or another a regular airport is not available, is also maintained. These fields number in excess of 1,500 and, due to the fact that they are not maintained for the sole purpose of aircraft operations, are not included in the listings in the airway bulletin given over to descriptions of airports and landing fields. A check is in constant progress of these fields, the information being held on file for the benefit of pilots making cross-country flights and for those who may wish to know of all recorded landing places along the routes to be followed.

As airports are completed and become available to aircraft operators, the section secures detailed information of facilities afforded in order that the airports in question may be included in the next revision of the airway bulletin.

Complete canvasses of proposed airports and airports under construction are regularly conducted so that the state of airport development may be known at all times. In addition the section is charged with recording all proposed airports, together with proposed improvements for existing airports, and keeping such records current. From such data a weekly bulletin service is prepared and distributed to the aeronautics industry as well as monthly airport development statements for publication in the Air Commerce Bulletin.

Information of value and assistance to pilots and air navigators, such as airport and airway changes, certification of private aeronautical lights, installation of aids to air navigation, etc., is published in the *Weekly Notices to Airmen.*

BOEING HAS ALWAYS BUILT TOMORROW'S AIRPLANES TODAY!

Swell trip... Great ship!

Even the most charming and capable stewardess knows that praise like this, from her passengers, is as much an endorsement of Boeing comfort features, as of her own hospitality.

BOEING

U. S. lines now flying Boeings: United Air Lines, Pennsylvania Airlines, National Parks Airways, Western Air Express, Wyoming Air Service.

THE AIR SERVICES

New Vought Tested For Navy

THE FIRST of 84 new scout-bomber airplanes under construction for the U. S. Navy by Chance Vought Aircraft at East Hartford took off from Rentschler Field recently on its initial test flight. Developed as a result of three years of design and testing in close cooperation with the Bureau of Aeronautics, the new type is expected to show higher performance characteristics than have previously been achieved by service types of airplanes of this class. It is a two seater biplane, designed to meet the limitations in size and landing speed imposed by the relatively small decks of the Navy's aircraft carriers, and is intended both for bombing and long-range scouting activities, which until now have been performed by two distinct types of airplanes.

The new airplane, designated as Model SBU-1 and illustrated on the front cover of this issue, represents a departure in many respects from the well-known Vought Corsair type. Its structure is composed of metal, with fabric covering except for the fixed tail surfaces, which are metal-covered. Outstanding among its new features is the use of the latest type NACA cowl with adjustable flaps which permits increased top speed as well as making possible the use of full power in climb without heating the engine. Other features include the use of split flaps on the lower wings, and a Hamilton Standard controllable-pitch propeller. The engine is a geared Pratt & Whitney Twin Wasp Junior, developing 700 horsepower at altitude.

Reserves Form Organization

AN OKLAHOMA CITY chapter of the Air Reserve Association of the United States has been formed, and Maj. W. C. Lewis, United States attorney, was named president. Other officers include Majs. B. S. Graham and Joe Neyer, vice-presidents, and Maj. Clint T. Johnson, secretary-treasurer. Other charter members of the chapter are: Majs. L. C. Geisendorf and R. F. Garland, Capts. E. R. Norris and W. E. Bleakley, and Lieuts. C. E. Page, R. L. Springer, John E. Cook, and C. Costant. The chapter will meet the first Saturday night of each month. Later a troop school, under direction of Capt. Ed Sullivan, commander of Hatbox Field, Muskogee, Okla., will be organized.

Oklahoma Base Moved

HATBOX FIELD, Muskogee, Okla., will be maintained as an airways station when the reserve base will be moved to Oklahoma City, Capt. Ed Sullivan, commander, said at the conclusion of an official visit to Oklahoma City. Capt. Sullivan has been named by Col. Ira Longanecker, air officer for the eighth corps area, as commander of the military base to be established at Oklahoma City and ordered transferred to Oklahoma City with five enlisted men.

The commander would give no date for the transfer, which includes three army planes. He and William Bleakley, air terminal manager at Oklahoma City, conferred on temporary storage for the ships and quarters for the men until a hangar and barracks are constructed.

Pending the actual move, however, Oklahoma City has been designated a regular base for transient army planes.

Allison Heads New York Reservists

LIEUT. WILLIAM C. ALLISON has relieved Lieut. Robert F. Hickey as commanding officer of the Naval Reserve Air Base, quartered at Floyd Bennett Field, Brooklyn, N. Y. Lieut. Hickey has been ordered to duty on board the U. S. S. *California*.

Lieut. Allison's latest duty was in the capacity of Fleet Air Photo Officer in VJ Squadron 1-F and he was a member, as well as photographic officer, of the 1934 Aleutian Survey Expedition.

Navy-Built Plane Tested

THE FIRST plane produced at the Naval Aircraft Factory, Philadelphia, under the provisions of the Vinson-Trammel Act has been flown by Naval personnel at Philadelphia. Designed as the third type of training plane constructed by the Navy, the XN3N is a two-place biplane, with dual controls, and is convertible into landplane or seaplane. Twenty-five feet in length, it has an upper wing span of 34 feet. The fuselage is fabric-covered and the plane, powered by a Wright Whirlwind, will have a speed of approximately 125 m.p.h.

Quantity production of this type of plane will be dependent upon the result of its trails, and if they are successful, they will be furnished chiefly to the Naval Air Station, Pensacola.

Air Base Bill Passed

THE SENATE passed and submitted to the White House for the President's signature the Wilcox bill authorizing establishment of six army air defense bases in the United States and Alaska. The bases would be used as permanent stations for training and for defense against invasion. The President signed the measure.

The bill carries no appropriation but the cost, to be provided for later, has been estimated at $110,000,000.

In selecting sites, the War Department is directed by the bill to consider the Atlantic northeast, Atlantic southeast and Caribbean areas, the Southeastern States, the Pacific Northeast, Alaska, and the Rocky Mountain area.

Naval Cadets Start Training

THE SECOND class of Naval aviation cadets assembled at the Naval Air Station, Pensacola, Florida, on August 20 for the Navy's prescribed course of aviation training. The 71 members of this class were selected from the first and second classes of candidates who were given a month's elimination and preliminary aviation training at the Naval reserve aviation bases throughout the country.

The cadets who qualify as naval aviators will be ordered to the fleet for three years' active duty.

Seventy-five Naval Reserve officers, qualified as naval aviation pilots, who have been on active duty, have been ordered to the station to assist in the training of all cadets under instruction there.

Hensley Field Improvements Sought

ACCORDING TO Capt. Bernard S. Thompson, commandant of Hensley Field, army field in Dallas, application for $212,000 has been filed for a government loan with which to make improvements on the runways and drainage facilities there. An original sum of $153,000, already assured has been requested by officials of the airport for the construction of the two runways. Further improvements call for $10,000 for servicing pits, and two 25,000-gallon auxiliary fuel storage tanks, which brings the aggregate amount expected to be expended to a total of $375,000.

Hangars Planned for Guardsmen

A NEW hangar is being planned for the Illinois National Guard squadron on two lots on the south side of the Chicago municipal airport. It will be a double unit designed to accommodate the larger planes expected to be built in the future. The plans, being drawn up under the supervision of Maj. Clifford A. McElvain, provide space for a photo section, communications department, and armament section.

Construction of a hangar for the 115th Observation Squadron of the Tennessee National Guards is also being planned at the new airport to be constructed at Nashville. The hangar will cost approximately $75,000.

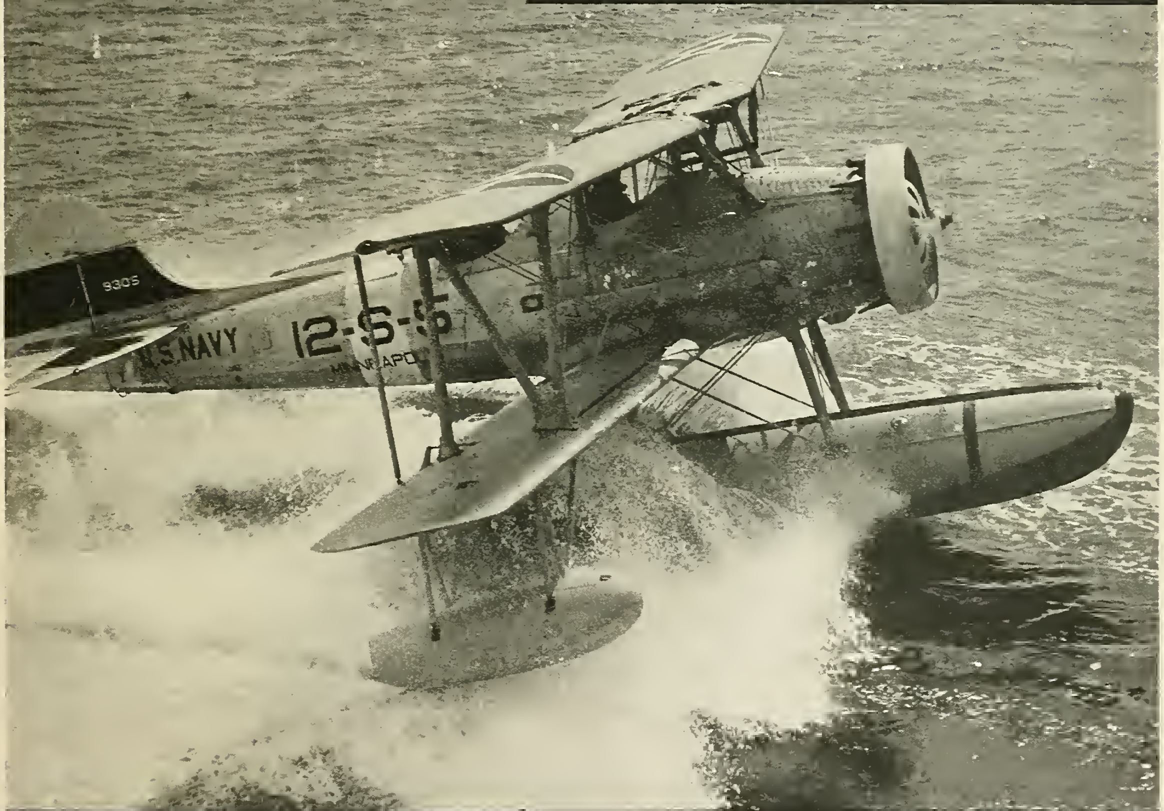
ZMC-2 Is Six Years Old

THE NAVY'S metalclad airship, ZMC-2, observed the sixth anniversary of her first flight by a training flight from the Naval Air Station, Lakehurst. Since taking off on her first flight from Grosse Ile Airport, Detroit, Michigan, on August 19, 1929, the ZMC-2 has flown approximately 60,000 miles during 1,425 hours in the air.

Built by the Metalclad Airship Corp., the ZMC-2 was the first successful airship with the hull, including the hull covering itself, built entirely of metal.

RELIABILITY

Every day in the year Vought Corsairs are operating with the U. S. Fleet—roaring off the carrier decks or shooting from the catapults of battleships and cruisers. In good weather or bad, the Corsairs perform unfailingly their part in the Navy's program for National Defense.



CHANCE VOUGHT AIRCRAFT

DIVISION OF UNITED AIRCRAFT MANUFACTURING CORPORATION

East Hartford, Connecticut

E. E. Wilson, General Manager C. J. McCarthy, Engineering Manager

PRIVATE FLYING AND CLUB NEWS

Club Activities

THE ANNUAL four-day air tour of Kansas is being planned by the Wichita Aviation Club and various aviation committees, for October 2 to 5. Invitations have been sent to 16 Kansas cities, asking for co-operation to make the tour a success. These cities are Coffeyville, Chanute, Neodesha, Emporia, Topeka, Salina, Concordia, Horton, Dodge City, Goodland, Garden City, Liberal, Hays, Great Bend, Pratt and Hutchinson. It is expected that the fleet will consist of at least 20 planes.

Aerial exhibits, an equipment display and the reading of more than 40 papers on aviation subjects are on the program of the 9th Aeronautic Meeting of the ASME scheduled to be held in St. Louis, October 10-12, inclusive. The St. Louis section of the society is sponsoring the meeting. Orville Wright is honorary chairman of the meeting, Amelia Earhart is honorary vice chairman and Maj. J. H. Doolittle, who is chairman of the aeronautic division of the society, is general chairman.

The Soaring Society of America is undertaking another expedition to the National Soaring Site at Big Meadows on the Skyline Drive in the Shenandoah National Park, near Luray, Virginia. The dates are from September 28 to October 13, inclusive.

Consul on Long Flight

A FLIGHT three-quarters the way around the world is being undertaken by H. L. Farquhar, first secretary of the British Legation at Mexico City. Farquhar's flight already has taken him from Mexico City to New York, Canada, Nome, Alaska, Siberia and China.

The plane is a Beechcraft B17R powered with a supercharged Wright Whirlwind engine of 420 h.p., and is equipped with a Lear radio directional compass.

Farquhar reached New York in leisurely stages from Mexico City and the plane was then re-equipped with Edo pontoons.

Local Events Attract Crowds

TROPHIES AND cash prizes totaling $3,800 were awarded at the two-day air show of the Aero Club at the Buffalo municipal airport Sept. 7-8. Despite a rain the second day, a crowd of about 3,000 daily attended. One new local record was established here, a 206.1 mile an hour average made by Art Chester, in the opening day's race for planes with 375 cu. in. displacement. Other first place winners included: Marion McKeen, 20-mile race; Chester, 500 cu. in race; Faye Lucille Cox, second-day parachute jump; Roger Don Rae, first-day parachute jump; Brewster Ward, second-day deadstick landing; Theodore H. Merckens, first-day deadstick landing contest. Lloyd Child, test pilot for the Curtiss company, demonstrated the company's new Army "mystery" ship during the races there.

ACTIVITIES AT THE SCHOOLS

Personnel Changes

ARCHIE McDONALD has been engaged by the University of South Dakota as an instructor in their newly organized Aeronautical Engineering Department, and Wesley Davis is now in charge of the parachute instruction at the Boeing School of Aeronautics.

Lt. Dan R. Robertson, president of the Robertson Aviation School, announced the appointment of Raleigh Shaffer as chief instructor of the Mechanic's School, and T. Claude Ryan appointed E. A. Ross head of the Ryan School of Aeronautics' ground school activities.

Enrollment Increase

WITH A record enrollment of 92 students in the September classes, bringing the total school enrollment to 358 active students, it has been necessary to establish a waiting list at the Casey Jones School of Aeronautics, Newark, N. J. Of the 92 new students, 48 enrolled in the day classes, 44 in the night.

Robertson Aviation School reports an increase in enrollments for the first half of September, with 14 students entering during that period and the Grand Central Flying School at Grand Central Air Terminal, Glendale, Calif., reported peak business during the latter part of August and early September. During the period, nine new students enrolled in the instrument flying course. In addition, four students enrolled in other courses given at the school.

Schools Improve Facilities

HEAVY INCREASES in recent enrollments have necessitated expansion of training facilities at the Ryan School of Aeronautics. Contracts have been let for construction of a new 7500 sq. ft. fireproof steel and stucco building which will be devoted for airplane drafting, aircraft welding, engine and airplane rigging departments.

Training in welding aluminum has been assisted at the Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal, Glendale, Calif., by the installation of hydrogen welding equipment. The new equipment will be used for advanced instruction. The present acetylene equipment will be retained for primary instruction in steel welding. Students' quarters in the terminal building, recently damaged by fire, were decorated with fresh paint and new woodwork and another room had been made available. The new room will be used by advanced design students.

Advance registration for the Fall term made it necessary to provide more classrooms and a larger restaurant building at Parks Air College, E. St. Louis, Ill. The restaurant will seat 230 persons, and the new classrooms measure 40 × 30 ft., 40 × 25 ft., and 30 × 20 ft.

New School Opens

IMPERIAL AIR College opened recently in Los Angeles with an initial enrollment of 10 students, is offering three regular courses; aeronautical drafting (24 weeks); airplane and engine master mechanics (48 weeks); and aeronautical engineering (2 years). In addition, a Home Study Course is being prepared. The school has leased a building which is within 12 minutes from the city.

Edo float equipped Wright-powered Beechcraft making world flight

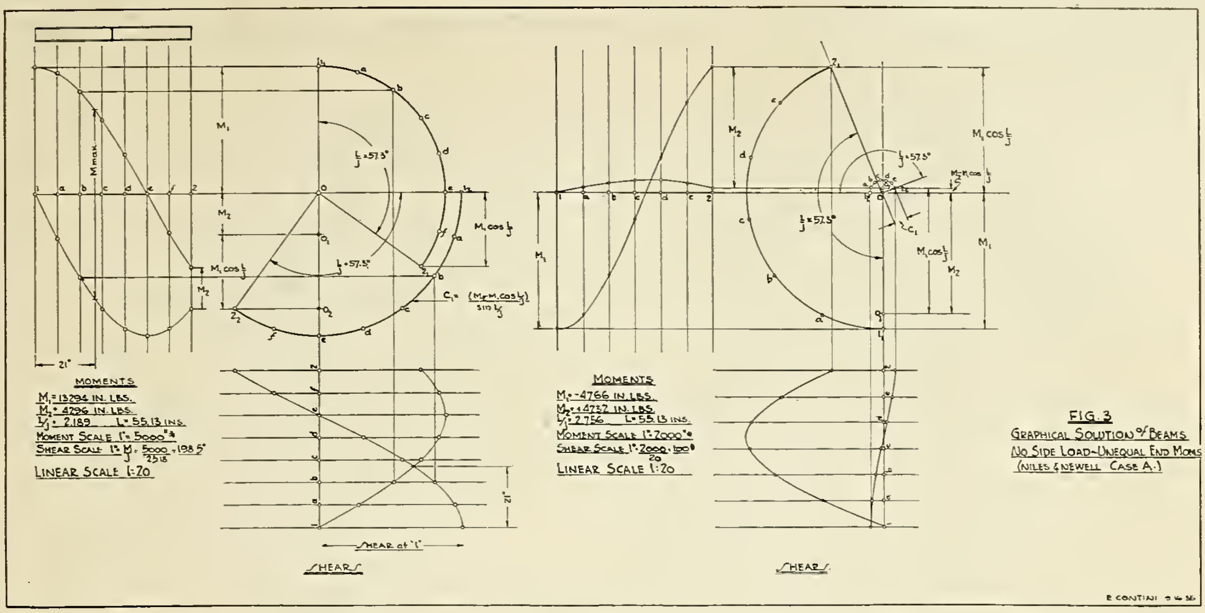


FIG. 3
Graphical Solution of Beams
No Side Load—Unequal End Moms
(Niles & Newell Case A.)

the above conditions do not hold, which is likely to be the case for columns with transverse load, the variation of signs of the basic functions suggests the use of a definite law of construction.

The Process of Construction

The graphical addition of two quantities of equal signs may be obtained, without regard to origin, by laying off the first quantity in one direction from the origin and the other quantity in the opposite direction. The linear distance between the two terminal points is the sum of the two quantities. This somewhat artificial procedure is chosen for reasons which will become obvious at the proof of the construction. If the two quantities are of opposite signs they are then plotted on the same side and both from the origin. The distance between the two terminal points in this case is the difference between the quantities, as illustrated in figure 2.

The above procedure is used in plotting M_1, M_2 and $f(w)$ in determining C_1 and C_2 and for the sake of uniformity M_1 and $f(w)$ are always plotted upward from the origin when positive while positive M_2 is always plotted downward from the origin.

The complete procedure for the solution and general proof is given for a problem under case A, page 201, Niles and Newell. The variations of construction and proofs are given also for the other cases.

Column with End Moments and No Side Loads

To illustrate the conventions set forth above, two examples are given for the first case, the end moments having been chosen of similar and opposite signs. The Precise equation for the moment at any point of the column is written:

$M_x = \{[M_2 - M_1 \cos(L/j)] \sin(x/j)\}/\sin(L/j) + M_1 \cos(x/j)$

in which

$C_1 = [M_2 - M_1 \cos(L/j)]/\sin(L/j)$

$C_2 = M_1$ and $f(w) = 0$.

The known quantities for the solutions

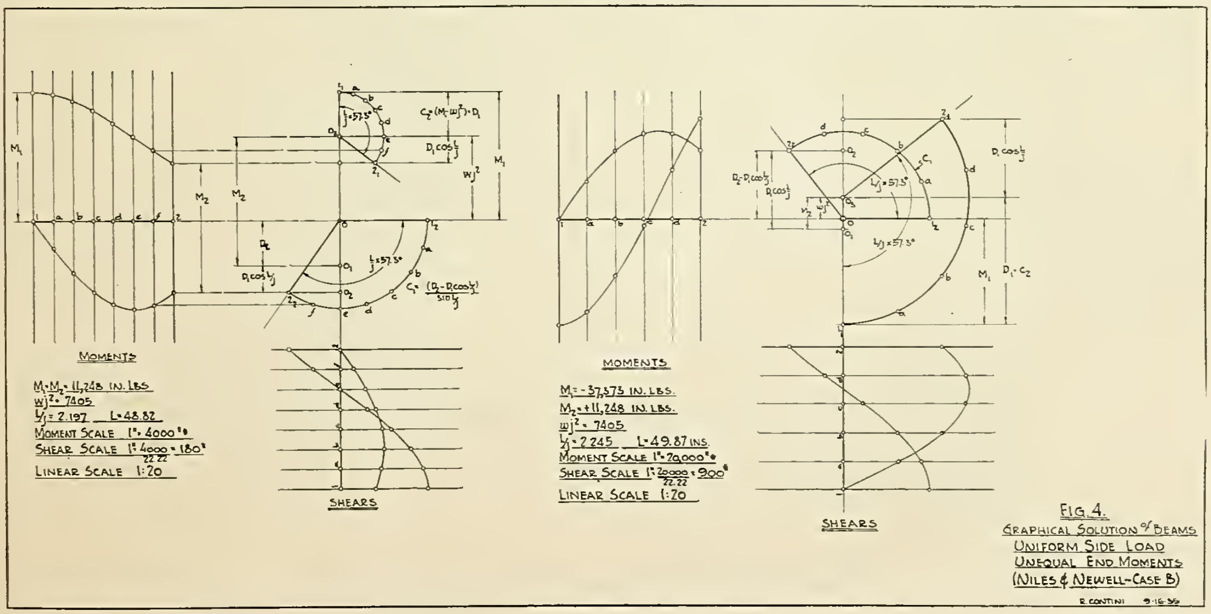


FIG. 4.
Graphical Solution of Beams
Uniform Side Load
Unequal End Moments
(Niles & Newell—Case B)

of the first problem illustrated in figure 3 are M_1, M_2, L/j and L.

Steps in Procedure

1. The column 1, a..2 of span L is represented by a horizontal line which is continued beyond the length of the column.

2. On the continuation of this line chose a center O, from which a line perpendicular to the extension of the base line 1—2 is drawn.

3. On the vertical axis, lay off upward O—1_1 equal to M_1.

4. From O—1_1 measure off an angle equal to $L/j \times 57.3°$, thus obtaining O—2_1.

5. Describe the arc 1_1—2_1 with radius equal to M_1. Since $M_1 = C_2$ the perpendicular distance from the base line to the point 2_1 is equal to $M_1 \cos (L/j) = C_2 \cos (L/j)$.

6. From O, lay off downward O—O_1 equal to M_2.

7. From O_1, lay off in the same direction as $C_2 \cos (L/j)$ (from the base line) distance O_1—O_2 equal to $C_2 \cos (L/j)$. Hence. the distance O—O_2 represents M_2—$C_2 \cos (L/j)$.

8. Through O_2, erect a perpendicular O_2—2_2 to the vertical axis.

9. From the base line measure off an angle $L/j \times 57.3°$ thus obtaining O—2_2. The intersection of horizontal line through O_2 and line O—2_2 defines the point 2_2. The distance O—2_2 is equal to $[M_2 — M_1 \cos (L/j)]/ \sin (L/j)$ which is equal to C_1.

10. With C_1 as a radius describe arc 2_2—1_2.

11. Divide distance 1—2, representing the span of the column, arcs 1_1—2_1, and 1_2—2_2 into the same number of equal parts. Designate the corresponding points with the same symbols.

12. Through the division points *a*, *b*, *c*, etc. of the column erect perpendiculars to it.

13. Project horizontally, corresponding points on the arcs onto the vertical lines passing through the corresponding points on the column.

Distances between the two intersections on the same vertical are equal to the bending moment at that point. The scale is the same as that used for M_1 and M_2.

The second problem illustrated in figure 3, is a case where the two end moments are of opposite signs. The procedure is identical in all its steps except 3. In 3, since M_1 is negative, according to the rule previously established, the distance O—1_1 equal to M_1 is now laid off downward from the base line.

Proof

The distance between the base line and the point on the arc C_2 is equal to $C_2 \cos (x/j)$. The distance between base line and the equivalent point on the arc C_1 is equal to $C_1 \sin (x/j)$. Hence the total distance is equal to $C_1 \sin (x/j) + C_2 \cos (x/j)$ which is the Precise equation for this case.

Solution for Shears

In the solution for bending moments, no mention was made of the direction of rotation in the development of the arcs C_1 and C_2. Regardless of the direction of rotation, i.e., if the arc C_2 had been developed in the opposite direction from the arc C_1, the results would have been identical.

However, if it is desired to obtain the shear curve, the development of the two arcs must be in the same direction of rotation, clockwise or counter clockwise.

The equation of Precise shear for this case of column loading is:

$S_x = \{[M_2 — M_1 \cos (L/j)]/ j \sin (L/j)\} \cos (x/j) — (M_1/j) \sin (x/j)$,

which may be also written as:

$S_x = (1/j)[C_1 \cos (x/j) — C_2 \sin (x/j)]$.

In figure 3, the horizontal distance from the vertical axis to any point on the arc $C_1 = C_1 \cos (x/j)$. The horizontal distance from the vertical axis to any point on the arc $C_2 = C_2 \sin (x/j)$. The horizontal distance between any point on the arc C_1 and the equivalent point on the arc C_2 is therefore $C_1 \cos (x/j) — C_2 \sin (x/j)$. The scale is the same as the one for the moments, so that the magnitude of the shear is obtained in the scale of M/j.

The steps required for obtaining the shear are:

14. On the continuation of the vertical axis draw the column with divisions as before.

15. Draw horizontal lines from the division points *a*, *b*, *c*, etc. of the column.

16. Project vertically, corresponding points on the arcs, onto the horizonal lines passing through the corresponding points on the column.

The distance between any two intersections on the same horizontal is equal to the magnitude of the shear at that point to the scale of M/j.

Other Loadings

In columns with uniform side load and end moments (this condition of loading is that classified as Case B in Niles and Newell) the expression is

$M = C_1 \sin (x/j) + C_2 \cos (x/j) + wj^2$

where

$C_1 = [(M_2—wj^2) — (M_1—wj^2) \cos (L/j)]/ \sin (L/j)$

and

$C_2 = D_1 = M_1—wj^2$

The graphical solution for this condition is illustrated by two problems in figure 4. The change in this condition from the previous one, is the introduction of the constant wj^2. This is taken care of by plotting both wj^2 and M_1 from the same origin, and plotting M_2 as a continuation of wj^2.

For the problems illustrated, the procedure is the following:

Steps 1, 2 and 3 are identical with Case A.

3a. From the origin O, lay off O—O_3 equal to wj^2, observing the pre-established rule of signs for its direction. (The distance 1_1—$O_3 = D_1 = M_1—wj^2$).

4a. Measure off an angle equal to $L/j \times 57.3°$ from O_3—1_1 with O_3 as a center, thus obtaining O_3—2_1.

5a. Describe the arc 1_1—2_1 with O_3 as a center and radius equal to D_1. Since $D_1 = C_2$, this is the arc C_2. The perpendicular distance from 2_1 to a horizontal line through $O_3 = D_1 \cos (L/j)$.

6a. From O_3 lay off O_3—O_1 equal to M_2. (The distance O—O_1 is equal to M_2—wj^2, or D_2.

The succeeding steps (7 to 13 inclusive) are identical to those of the previous case. The distance between the two intersections on the same vertical to the column are equal to the bending moment at that point on the column. The shears are obtained as for the previous case, with no change in the steps outlined.

The distance from the base and a point on the arc $C_1 = C_1 \sin (x/j)$. The distance between the base line and the equivalent point on the arc $C_2 = wj^2 +$

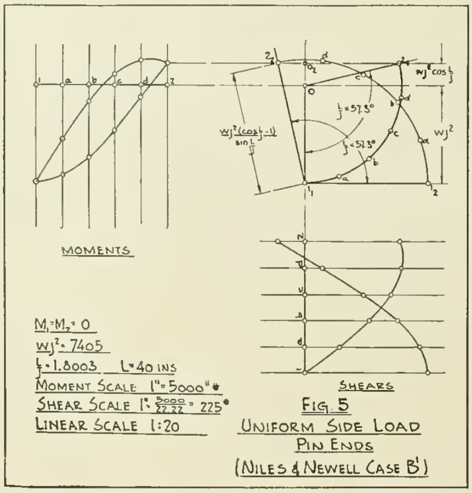

1
a
b
c
d
2
MOMENTS
2_1
d
O_2
O
c
$\frac{L}{j} \times 57.3°$
$wj^2 \cos \frac{L}{j}$
$\frac{wj^2(\cos \frac{L}{j} - 1)}{\sin \frac{L}{j}}$
$\frac{L}{j} \times 57.3°$
d
b
c
a
b
a
wj^2
1_1
1_2
N
d
SHEARS
$M_1 = M_2 = 0$
$wj^2 = 7405$
$\frac{L}{j} = 1.8003$ L = 40 INS
MOMENT SCALE 1" = 5000"#
SHEAR SCALE 1" = $\frac{5000}{22.22}$ = 225#
LINEAR SCALE 1:20

FIG. 5
UNIFORM SIDE LOAD
PIN ENDS
(NILES & NEWELL CASE B')

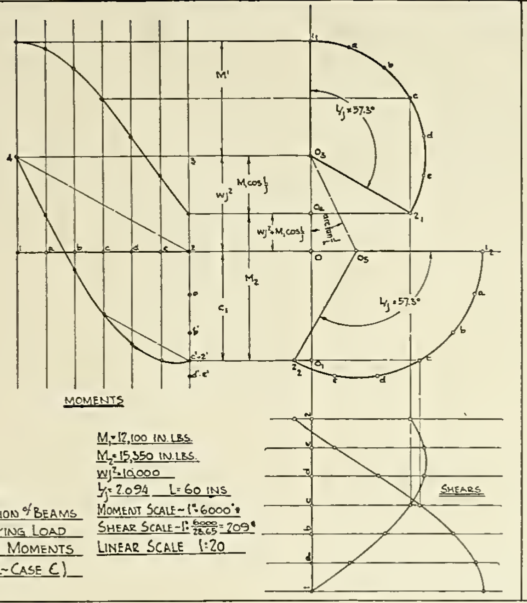

MOMENTS
SHEARS
M'
$M_1 \cos \frac{L}{j}$
wj^2
$wj^2 - M_1 \cos \frac{L}{j}$
M_2
C_1
$L/j \times 57.3°$
$M_1 = 17{,}100$ IN. LBS.
$M_2 = 15{,}350$ IN. LBS.
$wj^2 = 10{,}000$
$L/j = 2.094$ $L = 60$ INS
MOMENT SCALE – 1" = 6000"#
SHEAR SCALE – 1" = $\frac{6000}{28.65}$ = 209#
LINEAR SCALE 1:20

FIG. 6

GRAPHICAL SOLUTION OF BEAMS
UNIFORMLY VARYING LOAD
UNEQUAL END MOMENTS
(NILES & NEWELL–CASE C)

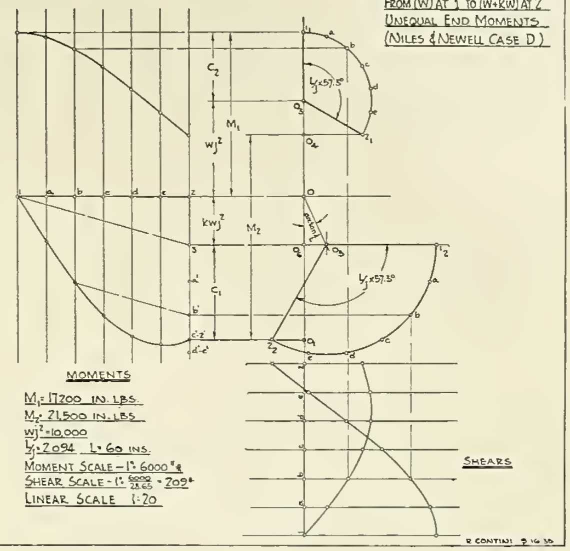


FIG. 7

UNIFORMLY VARYING LOAD
FROM (W) AT '1' TO (W+KW) AT '2'
UNEQUAL END MOMENTS
(NILES & NEWELL CASE D)

$C_2 \cos (x/j)$. Hence the total distance is equal to $C_1 \sin (x/j) + C_2 \cos (x/j) + wj^2$.

In columns with uniform side load and pin ends (Case B[1] in Niles and Newell) as illustrated in figure 5, the constants are:

$C_1 = \{wj^2 [\cos (L/j) - 1]\} / \sin (L/j)$,

and

$C_2 = wj^2$.

The steps in the solution are then 1, 2, 3a, 4 and 5. In step 5 the radius of the arc $C_2 = wj^2$. Step 6 is omitted and step 7 is automatically provided for in step 5. Step 8 is the same, but in step 9, the angle $L/j \times 57.3°$ is measured from a horizontal through point 1_1. The remaining steps 10—13 are identical.

The shears are obtained by following steps 14 to 16.

The distance $O—1_1 = wj^2$. The distance $O—O_2 = wj^2 \cos (L/j)$. Radius $1_1—2_2 = wj^2 [\cos (L/j) - 1] / \sin (L/j)$ or C_1. The distance from the base line to any point on the arc $C_1 = + wj^2 + C_1 \sin (x/j)$. The distance from the base line to the equivalent point on the arc $C_2 = wj^2 \cos (L/j)$. Therefore the total distance is equal to $C_1 \sin (x/j) - wj^2 \cos (L/j) + wj^2$ or $C_1 \sin (x/j) + wj^2 [1 - \cos (x/j)]$.

In the condition of columns with uniformly varying load and end moments solved graphically in figure 6, Case C given in Niles and Newell, the equation is:

$M = C_1 \sin (x/j) + C_2 \cos (x/j) + wj^2 \, x/L$,

in which

$C_1 = \{M_2 - wj^2 - [M_1 \cos (L/j)]\} / \sin (L/j)$ and $C_2 = M_1$.

Two changes arise in this condition. The first is the introduction of a variable third term in the moment equation, and the second is the addition of a third term in the shear equation. The procedure for allowing for these changes, graphically, is now discussed.

The third term in the moment equation, is a variable function of x. This is a linear variation, and may readily be obtained graphically. The method is shown as part of figure 6.

The distance 2—3 equal to wj^2 is plotted at the right end of the column, and a line joining 4 to 3 is drawn parallel to 1—2. Another line is drawn joining 4—2. Then by similar triangles at any point a distant x from the left end of the column, the distance intercepted by the lines 4—2 and 4—3 on a vertical through x, is equal to $wj^2 (x/L)$.

The introduction of the third term, wj^2/L in the shear equation is obtained by shifting the origin of the arc C_1 by an amount equal to wj^2/L horizontally from the origin of the arc C_2. This is shown in figure 6 as the distance $O—O_5$. The point O_5 is obtained by drawing line $O_3—O_5$ at an angle, arc tangent $= (j/L)$, to the line $O—O_3$. Since $O—O_3 = wj^2$, $O—O_5 = (wj^2) (j/L)$. However, since wj^2 is plotted to the same scale as the moments, and the scale for the magnitude of the shears is M/j, the distance $O—O_5$ (read to the shear scale) is equal to $(1/j) (wj^2) (j/L) = wj^2/L$.

The graphical sequence is as follows:

Steps 1 and 2 are as in the original procedure. Step 3 is replaced by 3b and 3c.

3b. On the vertical axis lay off a distance $O—O_3$ equal to wj^2.

3c. From O_3 lay off $O_3—1_1$, equal to M_1 or C_2.

Steps 4 and 5 are similar to the original.

5b. Through point 2, project line $2_1—O_4$ parallel to the base line intersecting the vertical axis at O_4. The distance $O_4—O$ is equal to $wj^2 - M_1 \cos (L/j)$.

6b. The distance M_2 is laid off as $O_4—O_1$ from O_4, rather than from O_1. The distance $O—O_1 = M_2 - wj^2 - M_1 \cos (L/j)$.

Step 7 is omitted, and step 7a, which allows for the constant term in the shear equation is substituted.

7a. Lay off $O—O_5$ such that $O—O_5$ is to $O—O_3$ as j is to L, that is, the angle $O—O_3—O_5$ is arc tan j/L.

8a. Through O_1 erect a perpendicular $O_1—2_2$, to the vertical axis.

Steps 9 and 10 are the same, using O_5, instead of O, for a center. The distance $O_5—2_2 = [M_2 - wj^2 - M_1 \cos (L/j)] / \sin (L/j) = C_1$.

Steps 11 and 12 are as in the original procedure.

Step 13 is modified in that the points on the arc C_2 only, are projected to corresponding lines on the column. The points on the arc C_1 are projected to the perpendicular at point 2 on the column (points a^1, b^1, etc.) and then parallel to 2—4 to the corresponding points on the column.

The shears are found by following steps 14—16, since the third term in the expression for shear has been accounted for by displacing the origin of arc C_1.

The distance vertically from the base line to a point on the arc $C_2 = wj^2 + C_2 \cos (x/j)$. The distance vertically from the base line to a point on the arc $C_1 = C_1 \sin (x/j)$. However, in projecting the points to the corresponding lines, by producing lines parallel to 2—4, the value $C_1 \sin (x/j)$ is reduced by an amount $(L-x)wj^2/L$. The total distance between the two points on any one line

$= C_1 \sin (x/j) - [(L-x)wj^2]/L + wj^2 + C_2 \cos (x/j)$

which when simplified gives the original form

$C_1 \sin (x/j) + C_2 \cos (x/j) + wj^2\, x/L$.

The shear measured between the two points on any one perpendicular to the column

$= wj^2(j/L) + C_1 \cos (x/j) - C_2 \sin (x/j)$.

Since these values have all been plotted to the scale M of the moments, if the magnitude of the shears is read to a scale equal to M/j, the resulting values

$= [wj^2(j/L) + C_1 \cos (x/j) - C_2 \sin (x/j)]/j$

which is the original equation for the shear.

The condition of columns with transverse load varying from (w) to $(l+k)w$, and end moments (Case D in Niles and Newell) combines the methods of Cases B and C, as is shown in figure 7. The Precise Equation for this condition may be written:

$M = C_1 \sin (x/j) + C_2 \cos (x/j) + wj^2 + wj^2kx)/L$

where,

$C_1 = \{M_2 - (1+k)wj^2 - C_2 \cos (L/j)\}/\sin (L/j)$

and,

$C_2 + M_1 - wj^2$.

Steps 1, 2, 3, 3a, 4a, and 5a are as for Case B, steps 5b and 6b are as for Case C.

6c. From O lay off downward $O—O_6$ equal to kwj^2.

7a. Lay off $O_6—O_5$ such that $O_6—O_5$ is to $O—O_6$ as j is to L. Steps 8a through to 13 are the same as for Case C. In step 13, the points on the arc C_1 are projected to the perpendicular at point 2 on the column, and then parallel to 1—3, to the corresponding lines on the column.

The distance from a point on the arc C_2 to the base line is equal to $C_2 \cos (x/j) + wj^2$. The distance from the corresponding point on the arc C_1 to the base line is equal to $kwj^2 + C_1 \sin (x/j)$. By producing this value along the span parallel to 1—3, it is reduced by an amount $[(L-x)kwj^2]/L$. The total intercept on the corresponding perpendicular to the column

$= C_1 \sin (x/j) + C_2 \cos (x/j) + wj^2 + kwj^2x/L$.

For the shears, the proof follows.

The distance horizontally from the vertical base line to a point on the arc $C_2 = C_2 \sin (x/j)$. The distance from the base line to the corresponding point on the arc $C_1 = (kwj^2)\,(j/L) + C_1 \cos (x/j)$.

The total distance along the perpendicular to the column at that point is $C_1 \cos (x/j) - C_2 \sin (x/j) + kwj^2/L$. Since the magnitude of the shears must be read to the M/j scale, the actual values will be:

$1/j[C_1 \cos (x/j) - C_2 \sin (x/j) + kwj^3/L]$ which is the equation for Precise shear.

Summary

The adaptability of this method of graphically solving many of the Precise Equations for beams and columns, has been shown by solutions for some of the various types of loading. It has been demonstrated that once the constants are determined, the procedure is reduced to a few simple operations. It has been also demonstrated that the constants, which can be obtained analytically if so desired are obtainable graphically by observing several preliminary rules of procedure.

The advantages of this method are the ability to visualize the shears and moments along the span, to determine the exact point of maximum moment, and to visualize the effects of several variables on the shears and moments.

References

U. S. Army Air Corps Information Circular No. 493, *Investigation of Structural Members Under Combined Axial and Transverse Loads.*

Niles and Newell—*Airplane Structures.*

Watter, *Aero Digest.* March, 1932. *Graphical Solution of a Beam.*

Jones. *Aero Digest.* June, 1935. *The Design of Beam Columns.*

Schwarz. *Aero Digest.* July, 1934. *Analyzing Wing Beams by Means of Polar Diagrams.*

Recent Aeronautical Patents

The following patents of interest to readers of AERO DIGEST recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Composite aircraft. Robert H. Mayo, London, England. (2,009,296)

Wing float. Earl J. W. Ragsdale, Norristown, Pa., assignor to Edward G. Budd Mfg. Co. (2,009,344)

Aircraft anchor. Alexander P. de Seversky, New York, N. Y., assignor to Seversky Aircraft Corp. (2,009,356)

Aircraft sustaining rotor. Joseph S. Pecker, Philadelphia, Pa., assignor to Autogiro Co. (2,009,703)

Aeronautical device. Howard I. Becker, Schenectady, N. Y., assignor to General Electric Co. (2,009,832)

Propeller. William H. Leinweber, Chicago, Ill. (2,010,094)

Gyro-controlled magnetic compass. Wesley G. Smith, Cranford, N. J., assignor to Eclipse Aviation Corp. (2,010,204)

Airplane wing. Walter D. Maring, Brooklyn, N. Y., assignor to McAllister Aircraft Wing Co., Albany, N. Y. (2,010,549)

Brake for gyro-stabilizers. Hollis Walter, Baldwin, and Francis P. Hodgkinson, New York, N. Y., assignors to Sperry Gyroscope Co. (2,010,681)

Aircraft. Abram A. Andersen, New York, N. Y. (2,010,743)

Airplane. Augustus M. Henry, Brooklyn, N. Y. (2,010,817)

Radio navigating system. John A. Willoughby, Washington, D. C. (2,010,833)

Tail wheel fairing. Ralph D. Carleton, Snyder, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,010,945)

Airplane motor propeller structure. Frederick E. Loescher, Harrisburg, Pa. (2,011,061)

Apparatus for towing a sign. Henry Y. Satterlee, Woodmere, N. Y., assignor to Kellett Autogiro Corp., Philadelphia, Pa. (2,011,202)

Hand hold for airplanes and like, and airplane. Robert G. Nightingale, Baltimore, Md. (2,001,253 and 2,011,254)

Lifting and propulsion device for use on air vehicles. Otto K. Quast, Spokane, Wash. (2,011,300)

Aircraft machine gun camera, and lens mount for cameras. John P. Gaty, Woodside, N. Y., assignor to Fairchild Aerial Camera Corp. (2,011,358 and 2,011,359)

Beacon system. Hans Scharlau, Berlin, Germany. (2,011,376)

Airplane altitude indicating system. Jetson O. Bentley, Castle Point, N. Y., assignor to General Electric Co. (2,011,392)

Gyroscopic compass. Leslie F. Carter, Leonia, N. J., assignor to Sperry Products, Inc. (2,011,436)

Parachute harness. Stig O. C. Kuhlemann, Stockholm, Sweden, assignor to Irving Air Chute Co., Buffalo, N. Y. (2,011,520)

Screw propeller. Auriol Barker, Thornleigh, N.S.W., Australia. (2,011,672)

Aircraft deviation indicator. Adolf Urfer, Richmond Hill, N. Y., assignor to Bendix Aviation Corp. (2,011,738)

Compass compensator. Wladimir A. Reichel, Philadelphia, Pa., and Philip F. Weber, Monmouth Beach, N. J., assignors to Bendix Aviation Corp. (2,011,775)

Flexible pipe for oil, essence, and like, especially for aerial machines. Giacinto Tabozzi, Milan, Italy. (2,011,781)

Speed reducing mechanism for driving airplane propellers. Norman H. Gilman, Indianapolis, Ind., assignor to General Motors Corp. (2,011,855)

Airplane. Alfredo G. Leigh, New York, N. Y., assignor to L. P. R. Co., Dover, Del. (2,011,902)

Cargo releasing device for aircraft. Albert A. Schwerin, Kingman, Ariz., and Stanley J. Bentley, Kittanning, Pa. (2,011,950)

Method of making propellers. Spencer Heath, Elkridge, Md., assignor to American Propeller Co., Baltimore, Md. (2,012,389)

Method of and apparatus for locating a point in space. Raymond M. Wilmotte, Boonton, N. J., assignor to Radio Corp. of America. (2,012,412)

The Technical Side of the Air Races

●

DR. ALEXANDER KLEMIN
Daniel Guggenheim School of Aeronautics
New York University

Photo by Skyview Camera Co., Cleveland

Benny Howard's "Mike" (left), "Mr. Mulligan" and the Ryder racer in the background

● With two or three exceptions, the main events of the 1935 National Air Races were contested by the same planes and pilots as in previous years, and there was hardly a challenge to the achievements of 1932 when Jimmy Doolittle set a world's land plane speed record of 294.38 m.p.h., over a 3-kilometer course and then flew at 252.7 m.p.h. to win the Thompson Trophy in his Gee Bee Sports-er. Even now that the depression is ifting it seems difficult to secure backers or the building of racing aircraft, and he races were only relieved of technical significance by the introduction of the TC events to encourage private owner atures. Yet as a spectacle the races were successful, attracting more than 200,000 spectators during the course of the meet.

Doug Davis' death last year prompted the formation of the Technical Committee of the Professional Racing Pilots' Association. To date it has produced some admirable rules for the stress analysis of racing craft. These rules however demand an amount of work which is almost as great as that required for an approved type certificate. If racing is to be, as sometimes in the past, a matter of careful but hurried work in the few months before the Nationals, then these rules must not grow too complex. This year no accidents occurred in the speed classics, and there was no evidence of flutter in fast ships several years old. At the Miami races last January, accelerometer records gave a maximum of 6.2 *g* for the Wedell racer. This year's records are not yet available until interpretation has been made by N. F. Scudder who has made this work one of his hobbies. Theory and practice both indicate that it is not necessary to raise accelerations to exaggerated values of *g* on turns to secure the best results. Perhaps this question of racing safety should be approached (a) by reasonable, but not too long-winded stress analysis; (b) real care in avoiding flutter (a subject which is becoming fairly well understood); and (c) the installation of a cheap, simple accelerometer with visual indication in the cockpit. (We understand that James

OFFICIAL RESULTS OF THE AIR RACES

Bendix Transcontinental Speed Dash

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Ben O. Howard, Chicago, Ill..	Howard Racer	Wasp	1,344	238.704	$4,500
Roscoe Turner, Hollywood, Cal.	Ring Free Sp.	Hornet	1690	238.522	2,500
Russell Thaw, New York, N.Y.	Gamma	Cyclone	1,823	201.928	1,500
Roy O. Hunt, Oklahoma City, Okla.	Orion	Wasp	1,344	174.766	1,000
Amelia Earhart, New York, N. Y.	Vega	Wasp	1,344	149.578	500

Ruth Chatterton Sportsman Pilot Trophy Race

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Grace E. Prescott, San Diego, Calif.	Travel Air	Wright	...	......	450
W. S. Woodson, Coronado, Cal.	Fleet	Kinner	...	......	250
Leland Hayward, Beverly Hills, Calif.	Waco	Wright	...	......	150
Cecile Hamilton, Beverly Hills, Calif.	Aeronca	Aeronca	...	......	100
Ethel A. Sheehy, Fontana, Cal.	Great Lakes	Cirrus	...	......	50

Event 1. 550 Cu. In. Displacement A.T.C. Race

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Geo. L. Harte, Wichita, Kans..	Cessna	Warner	499	141.578	360
Jack Morris, Pittsburgh, Pa...	Monocoupe	Lamhert	266	111.37	200
Kenneth Guinnip, Bradford, Pa.	Taylor Cuh	Aero-marine	160	71.73	120
Tex Rankin, Portland, Ore....	Ryan	Menasco	489	123.11	80

Event 2. 200 Cu. In. Displacement

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Percy V. Chaffee, Lake Delton, Wisc.	Nicholas Beazley	Pohjoy	173	125.305	270
Roger Don Rae, Lansing, Mich.	Allenhaugh	Salmson	173.7	124.069	150
Clarence MacArthur, Tampa, Fla.	Tilhury Flash	Church	108	115.789	90

Event 3. Greve Trophy Race, 550 Cu. In. Displacement

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Harold Neumann, Moline, Ill..	Howard Racer	Menasco	489	212.716	1,125
Roger Don Rae, Lansing, Mich.	Mod. Keith Ryder	Menasco	489	210.126	625
Art Chester, Glenview, Ill.....	Chester Spl.	Menasco	363	199.078	375
David Elmendorf, Palms, Cal..	Wedell Wms.	Menasco	439	175.106	250

Event 4. Women's A.T.C. Race

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Edith Bernson, So. Lincoln, Mass.	Bird	Kinner	372	81.909	562
Melha Beard, New York, N. Y.	Bird	Warner	422	80.964	312
Edna Gardner, Washington, D. C.	Porterfield	LeBlond	260	80.433	187
Genevieve Savage, Washington, D. C.	Great Lakes	Cirrus	310	79.535	125
Peggy Remey, New York, N.Y.	Travel Air	Wright	540	79.472	62

Event 5. 375 Cu. In. Displacement

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Art Chester, Glenview, Ill....	Chester Spl.	Menasco	363	189.384	945
Harold Neumann, Moline, Ill..	Fordon & Neumann	Cirrus	310	187.647	525
S. J. Wittman, Oshkosh, Wisc.	Wittman Spl.	Cirrus	349	187.164	315
Joe Jacohson, Kansas City, Mo.	Howard Spl.	Wright	318	153.027	210

Event 6. Greve Trophy Race, 550 Cu. In. Displacement

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Harold Neumann, Moline, Ill..	Howard Racer	Menasco	489	194.930	$1,125
Lee Miles, Tulsa, Okla.......	M. & A. Sp.	Menasco	363	189.603	625
S. J. Wittman, Oshkosh, Wisc.	Wittman Spl.	Cirrus	349	189.384	375

Event 7. 800 Cu. In. Displacement A.T.C. Race

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
George L. Harte, Wichita, Kans.	Cessna	Warner	499	141.35	360
John Ahhott, Detroit, Mich...	Beechcraft	Jacohs	589	149.36	200
Jack Morris, Pittshurgh, Pa...	Monocoupe	Lamhert	266	115.28	120
K. M. Guinnip, Bradford, Pa..	Taylor Cuh	Aero-marine	160	76.72	80
Tex Rankin, Portland, Ore....	Ryan	Menasco	489	122.69	40

Event 8. 375 Cu. In. Displacement

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Lee Miles, Tulsa, Okla........	M. &. A.	Menasco	363	197.772	945
Art Chester, Glenview, Ill....	Chester Spl.	Menasco	363	197.525	525
S. J. Wittman, Oshkosh, Wisc.	Wittman Spl.	Cirrus	349	188.875	315
Harold Neumann, Moline, Ill..	Fordon & Neumann	Cirrus	310	181.064	210
Joe Jacohson, Kansas City, Mo.	Howard Racer	Wright	318	152.225	105

Event 9. Greve Trophy Race, 550 Cu. In. Displacement

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Harold Neumann, Moline, Ill..	Howard Racer	Menasco	489	207.292	2,250
Marion McKeen, Los Angeles, Calif.	Brown Racer	Menasco	544	206.425	1,250
Roger Don Rae, Lansing, Mich.	Mod. Keith Ryder	Menasco	544	200.829	750
Art Chester, Glenview, Ill....	Chester Spl.	Menasco	363	189.148	500
S. J. Wittman, Oshkosh, Wisc.	Wittman Spl.	Cirrus	349	188.361	250

Event 10. 200 Cu. In. Displacement

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Percy V. Chaffee, Lake Delton, Wisc.	Nicholas Beazley	Pohjoy	173	119.657	270
Roger Don Rae, Lansing, Mich.	Allenhaugh	Salmson	173.7	114.489	150
Clarence MacArthur, Tampa, Fla.	Tilhury Flash	Church	108	114.376	90

Event 11. 375 Cu. In. Displacement

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Art Chester, Glenview, Ill....	Chester Spl.	Menasco	363	200.565	1,575
Lee Miles, Tulsa, Okla........	M. & A. Sp.	Menasco	363	193.671	875
S. J. Wittman, Oshkosh, Wisc.	Wittman Spl.	Cirrus	349	187.825	525
Harold Neumann, Moline, Ill..	Fordon & Neumann	Cirrus	310	178.722	350
Joe Jacohson, Kansas City, Mo.	Howard Racer	Wright	318	150.874	175

Event 12. Thompson Trophy Race

Pilot and Home Field	Plane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Money
Harold Neumann, Moline, Ill..	Howard Racer	Wasp	1,344	220.194	6,750
S. J. Wittman, Oskosh, Wisc..	Wittman Spl.	D-12	1,145	218.686	3,750
Roger Don Rae, Lansing, Mich.	Mod. Keith Ryder	Menasco	544	213.942	2,250
Joe Jacohson, Kansas City, Mo.	Howard Racer	Menasco	489	209.103	1,500
Lee Miles, Tulsa, Okla........	Seversky	Cyclone	1,823	193.594	375
Marion McKeen, Los Angeles, Calif.	Brown Racer	Menasco	544	188.859	375

	Race No.	Pilot	Airplane	Horsepower	Gross Wt.	Wing Ldg. lb/sq.ft.	Power Ldg. lb/hp.	Max.Speed 3 Kil. Crse.		Fuel Economy Detroit to Akron			Take-off and Climb 50' Barrier		Land over 50' Barrier and Stop		Points for Cabin, Brakes, Starter, etc.	Closed Course Obstacle Race				Total Points	Place
								M.P.H.	Pts.	Miles Per Gal.	Av. Speed M.P.H.	Pts.	Feet	Pts.	Feet	Pts.		Dist. to take-off over 10' Barrier Feet	Av. Sp. M.P.H.	Landing Distance over 10' Barrier Feet	Pts.		
550 Cu. In. Race	12	Geo. L. Harte	Cessna	145	2200	12.18	15.17	152.67	164	13.2	131.80	150	1000	0	658	68	64	900	141.53	550	33	479	1
	13	Tex Rankin	Ryan	95	1570	12.5	16.5	129.75	118	12.8	122.52	92	836	32	912	17	20	800	123.11	950	26	305	4
	16	Jack Morris	Monocoupe	90	1585	11.9	17.6	128.49	116	20.8	116.40	158	803	39	730	54	39	800	111.39	970	24	430	2
	18	K.M.Guinnip	Taylor Cub	40	950	5.06	23.8	84.27	28	23.9	69.75	115	650	70	456	108	26	500	71.73	670	22	369	3
800 Cu.In. Race	11	J.L.Abbot	Beechcraft	225	3150	11.5	14.0	169.64	198	11.3	145.00	171	1050	-10	1036	-8	79	900	149.36	690	33	463	2
	12	Geo. L. Harte	Cessna	145	2200	12.18	15.17	152.67	164	13.2	131.80	150	1000	0	658	68	64	900	141.35	480	34	480	1
	13	Tex Rankin	Ryan	95	1570	12.5	16.5	129.75	118	12.8	122.52	92	910	18	714	57	20	800	122.69	Not made		305	5
	16	Jack Morris	Monocoupe	90	1585	11.9	17.6	128.49	116	20.8	116.40	158	803	39	730	54	39	800	115.28	520	29	435	3
	18	K.M.Guinnip	Taylor Cub	40	950	5.06	23.8	84.27	28	23.9	69.75	115	650	70	456	108	26	500	76.72	580	24	371	4

Table I—Summary of results of the ATC races showing how each competing craft was rated

B. Taylor has successfully improvised such an instrument at a cost of about 65 cents.) The technicians are correct in seeking safety, but should not be so rigorous in their requirements as to prevent the construction of new planes.

In winning the Bendix Transcontinental Race, Benny Howard undertook some experimentation in sub-stratosphere flying. At times he was between 15,000 ft. and 20,000 ft., finding it helpful to take oxygen (at reduced pressure) at intervals of 15 or 20 minutes. Questioned as to the effects of the oxygen, he said that it fully answered the purpose for which it was intended, and had an exhilarating and almost intoxicating effect, particularly in sharpening the senses. Howard used 92 octane fuel to take off, 87 octane for cruising and had 100 octane for the Thompson Trophy race which Harold Neumann won in *Mr. Mulligan.* In Howard's opinion, the high octane fuel, with its large percentage of tetraethyl lead might conceivably lead to damage of the bronze valve seats and would not help the spark plugs.

When the N.A.A. authorities sought criticism of the rules for ATC plane competitions, they pointed out that the market for private planes was opening up and that the encouragement of more "private owner features" was of utmost importance at this time. Nothing is better calculated to encourage progress in private plane design than the introduction of such events at the National Air Races. There were two of these events at Cleveland, one for engines under 550 cu. in. displacement, the other for engines under 800 cu. in. The entries were well-known standard stock models, and included the Beechcraft, Cessna, Ryan, Monocoupe, and Taylor Cub. These planes were flown under exact ATC conditions as regards gross load, engine r.p.m., etc. The majority of the tests were made at Detroit, beginning a week before the actual races and the fuel economy test was flown between Detroit and Akron.

The tests comprised:

Obstacle Take-off and Landing: Take-off and landings over a light 50 ft. barrier. Points allowed: 1 point for each 5 ft. less than 1,000 ft.

Maximum Speed: Tests over 3-kilometer course. Points allowed: 2 points for each mile above 70 m.p.h.

Speed Economy Run: Closed 150-mile circuit, with at least two turning points and no stops. Points allowed in accordance with the following formula:

$$\frac{(\text{useful ld.})\ (\text{mi. per gal.})\ (\text{av. sp./max. sp.})}{70}$$

Private Owner Features: The following characteristics of special interest to the private owner were allotted points:

	Points
(a) Field of visibility. . (maximum)	20
(b) Additional passengers besides pilot . . . . (each)	10
(c) Side-by-side seating arrangement	5
tandem seating	3
(d) Enclosure—cabin	10
Enclosed cockpit	5
(e) Engine starter—electric or air	5
hand inertia	3
hand crank	1
(f) Baggage—for each 10 pounds per occupant	1
plus, for each cubic foot per occupant	1
(g) Dual control	3
(h) Adjustable trim for balance—longitudinal	2
lateral	1
directional	1
(i) Landing lights	3
(j) Heating	2
(k) Ventilation	2
(l) Tail wheel	2
(m) Adjustable seats	2

Closed Course Speed Sprint: Five laps around a 5-mile closed course, take-off and landing over a 10-ft. barrier in a lane 100 ft. wide. Points allowed: Take-off and landing, 1 point for each 100 ft. from 1,000-ft. mark, distance measured from the point on the aircraft furthest from barrier; speed, 1 point for each 5 m.p.h.

The results of these events for the Cessna, Beechcraft, Monocoupe, Taylor Cub and Ryan planes, are briefly summarized in the accompanying table.

While a detailed break-down of the points secured in the private owner features test is not available, and space does not permit a complete analysis, certain interesting conclusions may be drawn.

The Cessna scored 64 points for the private owner features. On a fair allowance for baggage weight and cubic foot capacity, it is estimated that it might have scored 80 points. Hence its allowance for vision at the hands of experienced and unbiased judges headed by Fred Weick (to whom credit is due for his work on rules and tests) and established by the N.A.C.A. method could not have been so bad. It seems good vision is attainable even in a tractor cabin job. Nor are our current stock models so very deficient from the point of view of private plane features and conveniences.

If the Monocoupe can cruise at 116.4 m.p.h. and travel 20.8 miles to the gallon, then the fuel economy of American private airplanes may be regarded as satisfactory.

The contestants did better in take-offs and landings in Detroit, where they had the advantage of practice attempts than at the races where only one attempt was allowed. Definite practice in take-off and landings over obstacles might well be part of the training of an experienced flier.

Landing figures are gratifying. A greater effort must be made in the near future to secure shorter take-offs over obstacles, if the ideal of utilizing small landing fields is to be attained.

In take-offs reducing power loadings does not help much. The all-important factor is low loading per square foot, which entails a prohibitive sacrifice of general performance. There is a dilemma facing our designers on this score.

In the Cessna, winner in the private plane races, we noticed a novelty in streamlining. The lower part of the rudder was bulged out so as to provide a fairing for the tail end of the fuselage. The Cessna used an enormous tab on the elevator which was said to be very effective.

The Beechcraft, even though it did not

(*Continued on page* 81)

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Stalling Tests

The Reaction on a Wing whose Angle of Incidence is Changing Rapidly. Wind-Tunnel Experiments with a Short-Period Recording Balance, W. S. Farren. (British) Aeronautical Research Committee —Reports and Memoranda No. 1648, *January* 15, 1935 (*Published August* 13, 1935), 24 *pp.,* 25 *figs. on supplementary plates.*

A BALANCE is described which was developed in the Aeronautics Laboratory at Cambridge, for use in recording the reaction on a wing whose angle of incidence is increasing or decreasing rapidly. In determining the characteristics of wings at or near the stall, it was found that a large "hysteresis" effect existed above the stall for all types of wing tested and that the force-angle curve was a function of both the rate of change of angle and of the sense of the change. The magnitude of the effect depended to some extent on the shape of the wing profile.

Biplanes

A New Form of Biplane, H. B. Irving. Aircraft Engineering, Vol. 7, No. 76, June, 1935, *pp.* 133-138, 13 *figs.*

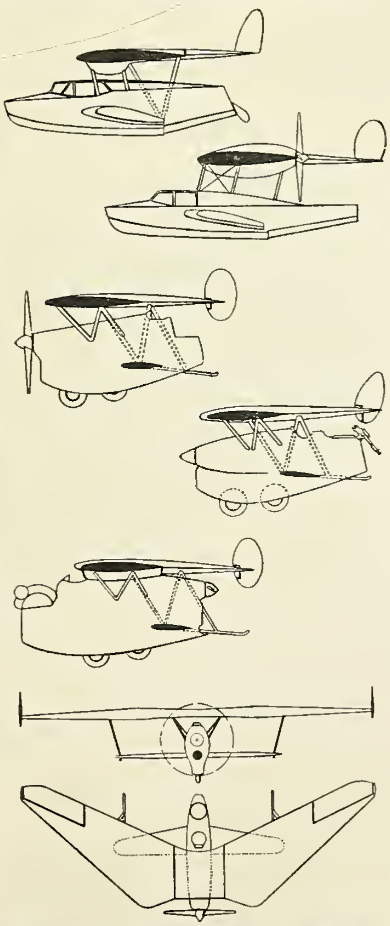
THE DESIGN of a new type of biplane which has advantageous qualities in roll above stall is described. The author outlines the results of experiments made in the Aerodynamics Department of the National Physical Laboratory in the development of the new plane. The wings converge towards the tips owing to the lower wing being given an unusually large dihedral angle of 12½°. The lower wing is swept forward 10° and is of constant chord while the upper wing is highly tapered. Stability in roll above the stall is obtained without appreciable sacrifice apart from that inherent in the biplane as compared with the monoplane. There are gains in maximum lift coefficient, steeper gliding angle for coming in to land, and improved aileron control.

Bird and Insect Flight

Modern Ideas on Animal Flight (Conceptions modernes sur le vol animal), R. S. Lacape. L'Aéronautique, Vol. 17, *No.* 194, *July,* 1935 (*L'Aérotechnique Supplement*) *pp.* 61-75, 17 *figs.*

RESEARCH UNDERTAKEN by Dr. A. Magnan on the flight of birds and insects is described. The apparent nonconformity of the laws of the resistance of air to the flight of birds is pointed out and a cinematic analysis of flapping in sinking, encircling and rising is given with photographs of the front, side and top views of pigeons and sea gulls in these three phases. The flow of air around the beating wings is studied by means of smoke and the dynamic effect of beating determined experimentally. The theory of flight by reaction or propulsion and by depression or lifting force is explained.

The principal characteristics of various birds and insects are compared, including weight, length, and wing span and width, and a constant product found between the length of the bird's wing and number of beats per second. Dr. Magnan believes that the wing area of birds is larger than necessary and that the leading edge plays an essential part. The motive power of both birds and insects is evaluated by an experimental determination of the power actually consumed in flight. Reference is also made to a study of mechanical beating flight.



Outlines of the tractor type Hill Pterodactyl and suggested variations as a pusher and flying boat, from the August issue of the French magazine "l'Aerophile"

Airplane Welding

Welding in Aeroplane Construction, H. Sutton. Aircraft Engineering, Vol. 7, No. 77, July, 1935, *pp.* 178-180, 4 *tables.*

CONDITIONS IN which welded construction for airplanes is permissible under British regulations are discussed. The author gives the results of tests made on welded carbon and manganese steels, austenitic non-corrodible steels and chrome-molybdenum steels, comparing the properties of the last with those of low-carbon steel. He considers that the results so far obtained in the investigation of the hydrogen-arc welding process have been very promising. He concludes with an outline of the research work on the properties of welds and various methods of welding in progress at the Royal Aircraft Establishment at Farnborough.

Airplane Noise Reduction

The Noise of the Airplane (Il rumore nei velivoli), D. Verticchio. Rivista Aeronautica, Vol. II, No. 8, *pp.* 242-272, 12 *figs.*

PHYSICAL ASPECTS of the acoustics phenomena, as well as the physiological effects of the noise of the airplane on the pilot and passengers, are presented, and the theories of Fletcher and Munson, Kingsbury, Davis, Willms, Geiger, Abbott, Barkhausen, Schmidt and Kauffmann, and Helmholtz are outlined. The author takes up the question of reducing noise at its source, such as that of the propeller and engine, and compares the noise resulting from geared and ungeared engines.

In describing methods for the acoustic insulation of the cabin, he gives the coefficient of sound absorption, per unit area, thickness, weight, and frequency for various materials. He also discusses the problem of absorbing the residual noise which may penetrate the cabin in spite of the insulation, comparing electrical and mechanical acoustical filters.

Shock Absorbers

Hydraulic Shock Absorbers Employed in the Landing Gears of Airplanes (Ammortizzatori idraulici impiegati nei carrelli degli aeroplani), P. Aymerito. L'Aerotecnica, Vol. 15, *No.* 6, *June,* 1935, *pp.* 567-595, 21 *figs.*

A METHOD is described for calculating the area of the outlet hole of a hydraulic shock absorber with a total constant resistance and taking into account the pneumatic action of the tires. The mass effect added to that of viscosity is also considered. The designs of various types of shock absorbers are discussed including those of Dowty, Faudi, Morane, Messier, Dyle et Balacan, Vicars, Scylla, Kellner-Béchereau, Blackburn, Siderstrand, Fast, Bulldog, and Atlas, as well as the Fast absorbers for tail wheels.

CURRENT PRACTICE IN INSTRUMENT PANEL LAYOUT

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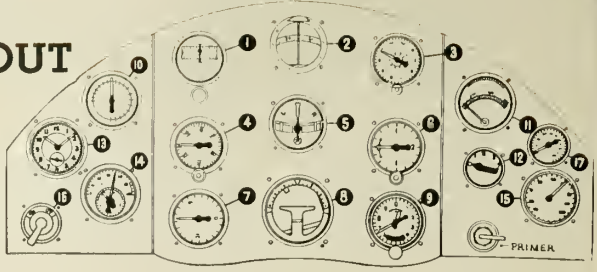
(Continued from the September issue)



Panel of Amelia Earhart's trans-Pacific Lockheed

Earhart's Lockheed Vega

The airplane in which Amelia Earhart this year set two world's records is a P. & W. Wasp-powered high-wing Lockheed Vega especially fitted for long-distance flying. In it Miss Earhart made the first solo flight across the Pacific from Hawaii to Oakland, and the first non-stop flight from Mexico City to New York.

The arrangement of the instrument panel of this plane is illustrated here, and the description of the instruments is numbered to correspond to the diagram (model numbers of instruments are indicated in brackets).

1—Sperry gyroscopic compass (306). 2—Kollsman direct-reading compass (65L-13). 3—Pioneer altimeter (515B-168) 4—Pioneer airspeed indicator (725-17). 5—Pioneer turn and bank indicator (385-949). 6—Pioneer rate of climb indicator (374-2704). 7—Pioneer tachometer (347-969). 8—Sperry gyro-horizon. 9—Kollsman sensitive altimeter (31-01-545). 10—Pioneer supercharger pressure gauge (737-96). 11—Weston thermocouple selective switch. 13—Wittnauer clock. 14—Kollsman oil temperature, pressure and fuel pressure gauge (50-02-17). 15—Kollsman ice warning indicator (47-02-249). 16—Scintilla ignition switch (E5). 17—Pioneer inlet oil temperature gauge (506B).

Also in the cockpit is a complete electrical switch bank with individual switches for the entire plane, the landing and navigation lights. Another compass (Pioneer) is on the left side at the seat, and on the right side is a 50-watt Western Electric radio transmitter. Mounted on the left bulkhead is a Weston ammeter, and on the right bulkhead a Weston voltmeter and ammeter. The Lear radio compass is on the right wing panel.

Consolidated XP2Y-1 Flying Boat

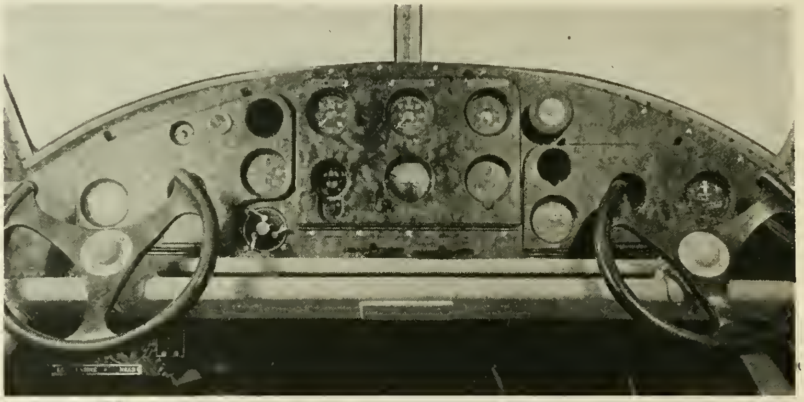
Designed in three sections, the instrument panel of the Consolidated XP2Y-1 illustrates the achievement of design for easy and quick maintenance and inspection. Each section mounted on the main panel is equipped with a hinge that runs the entire length of the section and is held in place by clamps. Convenient knobs at the top provide a hold to permit pulling the section outward, thus rendering accessible the rear of the unit without the necessity of removing the entire section.

The tri-motored patrol flying boats in which this instrument arrangement was featured were among the first types made for the Navy by the Consolidated company, and were superceded subsequently by the twin-engined flying boats now in service.

Center panel: each name plate of the right, center, and left engine is at the top, arranged in three rows, under which are the electric tachometers for the respective power plants. In addition there is a directional gyro, inclinameter, Sperry horizon and altimeter. Below this panel are two emergency bomb release handles.

Left panel: signal light, pilot director indicator; turn and bank indicator, Mark VI compass, airspeed indicator. Directly beneath this panel is the electrical switch bank with the selector switches, pyromillivolt meter, and other switches. Between the center and left panel, and mounted on the main board is the Scintilla ignition switch.

Right panel: clock, Mark VI compass, turn and bank indicator; airspeed indicator. On the main panel and above this unit, is a rudder return control knob.



Above, the panel of the tri-motored Consolidated type XP2Y-1 flying boat

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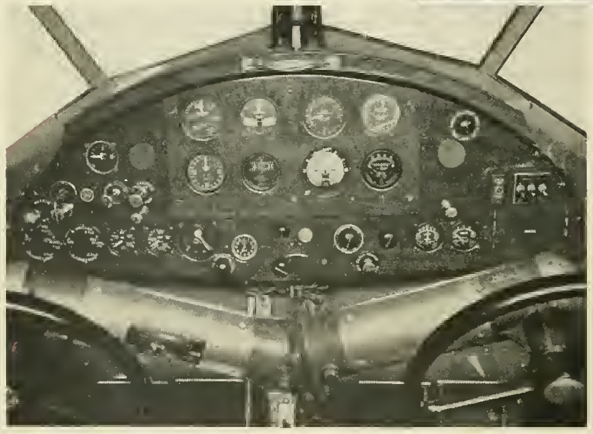

Left, arrangement of instruments in the latest Laird LC sesquiwing

Laird LC-EW 450

The instrument panel in this latest type Laird cabin sesquiplane is made up of two sections bolted together and forming a semi-elliptical shape. The center panel, which is mounted on Lord shock absorbers, contains the flight instruments; to the left of it are the engine instruments and controls, and to the right, the electrical units.

Stabilizer area	17.2 square feet
Elevator area	15.76 square feet
Fin area	6.6 square feet
Rudder area	9.4 square feet
Total aileron area	14.6 square feet
Total flap area	13 square feet
Empty weight	2600 pounds
Useful load	1610 pounds
Gross weight	4210 pounds
Fuel capacity	140 gallons
Oil capacity	12 gallons

Performances

Maximum speed, (830 h.p. at sea level)	287 m.p.h.
Maximum speed, (550 h.p. at sea level)	251 m.p.h.
Maximum speed 550 h.p. at 11,000 ft.)	292 m.p.h.
Cruising speed (sea level)	231 m.p.h.
Cruising speed (11,000 ft.)	262 m.p.h.
Cruising speed (17,000 ft.)	292 m.p.h.
Rate of climb (550 h.p.)	2800 ft./min.
Rate of climb (830 h.p.)	4450 ft./min.
Landing speed (with flaps)	64 m.p.h.

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NATIONAL AIR RACES

ents are

ntinued from page 76)

proofed mounting

The main board on the B17L includes two panels, one containing flight instruments, the other engine instruments. Grouped across the bottom of the main installation are the electrical units, while the Kollsman compass, throttle and landing gear handle are placed between the two panels.

Left panel: Pioneer airspeed indicator, Sperry gyro-horizon, Kollsman rate of climb indicator; Pioneer turn and bank indicator, Sperry directional gyro, Pioneer sensitive altimeter.

Right panel: Pioneer tachometer, Pioneer-Waltham clock, Weston oil temperature indicator; Pioneer oil pressure gauge, Kollsman engine thermometer, Pioneer fuel pressure gauge.

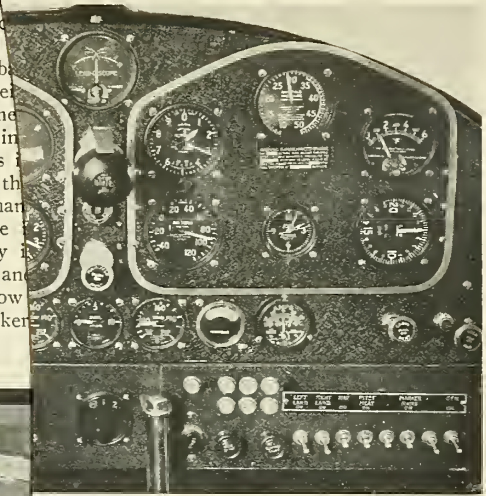
Across the bottom and below the two panels are the tail wheel lock handle, manifold heater control, fuel tank selector valve, mixture control, primer, landing gear motor ammeter, instrument light rheostat, landing light toggle switches and the heater control throttle. When the radio is installed as shown in the accompanying illustration, it is placed below the controls at the left of the board. At the lower right hand section beneath the light panel is the flare release control unit directly above which is a compartment for the flares themselves.

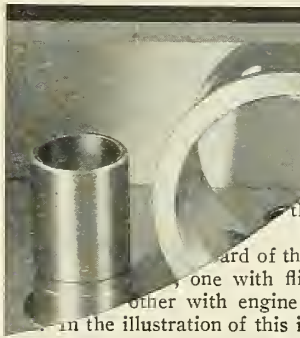
Beechcraft A17F

In general appearance, the instrument panel of the A17F is similar to the B171, except that it is more compact, and the electrical instruments and switch bank are placed differently. This board has a

don and introduce some set mili
such as the destruction of a
village.

We must have aerial acrob
aerobatics, at any race. But the
in thrills diminishes with the
We seem to remember that both in
and Germany there are contests
batics with definite points for th
racy and neatness of certain man
Similar contests would enhance
to a greater extent, particularly
explained. With experience an
sistence it is possible to follow
maneuvers, but to many onlooker





the elec-

ard of the A17F
one with flight in-
other with engine instru-
in the illustration of this installation the Weston Lear-O-Scope directional indicator, throttle, mixture control, and manifold heat control are installed on the central portion of the board.

Left panel: Pioneer airspeed indicator, Sperry directional gyro, Pioneer turn and bank indicator; Pioneer rate of climb indicator, Sperry gyro-horizon, Kollsman sensitive altimeter.

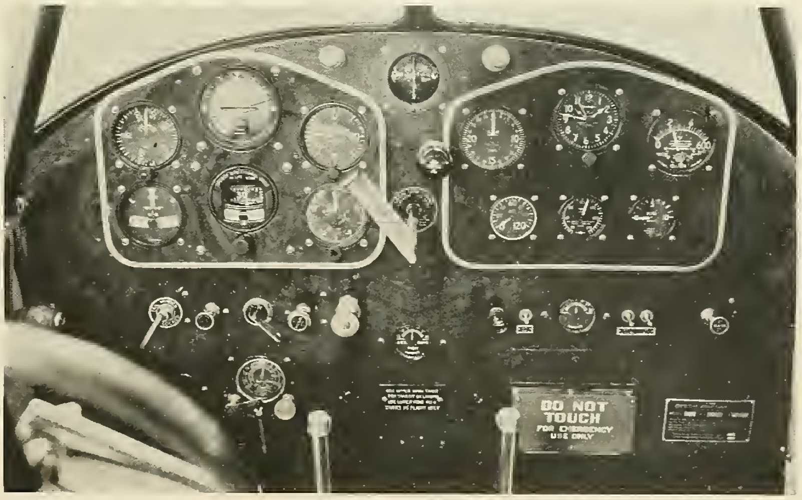
Right panel: Kollsman sensitive altimeter, Kollsman manifold pressure gauge, Lewis thermocouple; Kollsman air temperature indicator, Pioneer-Elgin clock, Pioneer tachometer.

Directly below the two panels are the tail wheel lock control, propeller pitch control, priming pump, Kollsman suction indicator, Pioneer oil pressure indicator, Pioneer temperature indicator, Pioneer fuel pressure indicator, hydrostatic fuel level gauge, combination voltmeter-ammeter, throttles which control the cooling and heating of the cabin.

Along the bottom row are the Lear-O-Scope tuning meter and below it the rheostats for volume control of the radio headphones and for the compass meter. Next to it are the Lear-O-Scope tuning and wave length band selector units, Scintilla magneto switch, fuel tank switch, starting button, and above it the booster push button, a group of six push buttons for selectively indicating fuel and oil level in various tanks and below these, rheostats for controlling the intensity of the illumination of the instrument lights and the compass lights. At the extreme right hand side of this panel is a group of toggle switches for the lighting system.

●

Panel of the Beechcraft B17L



The Howard DGA6 — “

● Winner of the two foremost events of the 1935 National Air Races at Cleveland. *Mr. Mulligan* is a four-place high wing cabin monoplane designed by Ben O. Howard who flew it to first place in the Bendix Transcontinental Race at an average speed of 238.704 m.p.h. Howard used 92 octane fuel to take off, 87 octane for cruising and had 100 octane in the plane when Harold Neumann flew it to win the Thompson Trophy. A description of *Mr. Mulligan* appeared in the October, 1934 issue of Aero Digest. Since then the plane has undergone several minor changes.

Designated as the Howard DGA6, it is of strictly conventional structure, built and stressed in accord with ATC requirements, with load factors higher than those demanded by the Department of

Commerce. Welded steel tubing is utilized in the construction of the fabric-covered fuselage, and the cabin has twin tandem seats, dual controls, and a baggage compartment. The size of this compartment is illustrated by the fact that Howard and his co-pilot, Gordon Israel, carried with them in the Bendix race, their baggage, emergency food, and other rations and tools. Fireproof *Plasticyl* is used to give clear visibility ahead and to the side, the windshield fairing into the leading edge of the center wing section.

Wings, utilizing an NACA 2412 airfoil section, are of solid spruce spars, built-up ribs, and internal drag bracing incorporated by tie rods. Covering is by .0781 in. 3-ply Haskelite spruce plywood, over which is doped fabric. Flaps are carried out to the strut points and placed over the center position of the high wing monoplane.

Ailerons and elevators are push-pull, tube-operated, and neither is statically balanced. Although the ship has been dived to more than 400 m.p.h. with hands and feet off the controls, Howard reports no evidence of flutter.

Tail surfaces, like the fuselage, are also of welded steel tubing, fabric-covered. The rudder is operated by cable controls from the cockpit, and also does not incorporate static balance.

Rubber discs in compression are employed in the fixed, split-type landing gear for shock absorption, the length of deflection being 8 in. Goodrich 7.50-10 tires are used, being housed in metal streamlined fairings. The upper portion of each landing gear leg is used as the lower fixture for the streamlined wing strut braces, the upper end fitting into a streamlined overlapping section on the underside of each wing panel. Further wing bracing is obtained by vertical strut on both sides.

The cowl is a non-split, single piece unit solidly fastened. It houses a P. & W. Wasp SE engine, rated 550 h.p. at 11,000 ft., but which is capable of delivering a maximum of 830 h.p. at sea level. The engine utilizes a 13.85:1 supercharger gear and a 6.05:1 compression ratio and is equipped with a Lycoming-Smith controllable-pitch propeller. Its normal cruising output is 415 h.p.

Included in the special equipment carried in *Mr. Mulligan* was a duplicate set of blind-flying instruments, dual RCA radio receivers, and sufficient oxygen to supply the pilots for 8 hours.

At the take-off for the start of the Bendix, the plane carried a load of 2700 lbs., giving it a gross weight of 5300 lbs. against its designed 4210 lbs., and increasing the wing loading to more than 39 lbs./sq.ft., compared with its standard 30.7 lbs./sq.ft. Nevertheless, it took off after a run of 1500 ft., without utilizing more than 550 h.p. In its qualifying speed at Cleveland, *Mr. Mulligan* flew the closed course with 650 h.p. attaining 247 m.p.h., while in the Thompson, its average output of 485 h.p., gave it an average speed of 220 m.p.h.

Specifications and performance figures of the Howard DGA6 are as follows:

Wing span	31 feet 8 inches
Length overall	25 feet 1 inch
Wing area	150.7 square feet
Wing loading	30.7 lbs./sq. ft.
Power loading	7.65 lbs./h.p.
Chord	5 feet 6 inches
Incidence	.075 degree
Dihedral	0 degrees

CE IN LAYOUT

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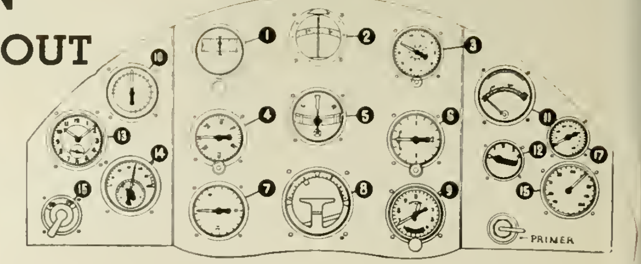


Panel of Amelia Earhart's trans-Pacific Lockheed

r, and on the right bulkhead a Wes- voltmeter and ammeter. The Lear › compass is on the right wing panel.

Consolidated XP2Y-1 Flying Boat

:signed in three sections, the instru- panel of the Consolidated XP2Y-1 rates the achievement of design for and quick maintenance and inspec- Each section mounted on the main equipped with a hinge that runs length of the section and is by clamps. Convenient ovide a hold to permit ard, thus render- it without

featured were among the first types made for the Navy by the Consolidated company, and were superceded subsequently by the twin-engined flying boats now in service.

Center panel: each name plate of the right, center, and left engine is at the top, arranged in three rows, under which ar the electric tachometers for the respective power plants. In addition there i a directional gyro, inclinameter, Sperr horizon and altimeter. Below this pan are two emergency bomb release handle

Left panel: signal light, pilot dir indicator; turn and bank indic VI compass, airspeed in

Stabilizer area	17.2 square feet
Elevator area	15.76 square feet
Fin area	6 6 square feet
Rudder area	9.4 square feet
Total aileron area	14.6 square feet
Total flap area	13 square feet
Empty weight	2600 pounds
Useful load	1610 pounds
Gross weight	4210 pounds
Fuel capacity	140 gallons
Oil capacity	12 gallons

Performances

Maximum speed, (830 h.p. at sea level)	287 m.p.h.
Maximum speed, (550 h.p. at sea level)	251 m.p.h.
Maximum speed 550 h.p. at 11.000 ft.)	292 m.p.h.
Cruising speed (sea level)	231 m.p.h.
Cruising speed (11.000 ft.)	262 m.p.h.
Cruising speed (17,000 ft.)	292 m.p.h.
Rate of climb (550 h.p.)	2800 ft./min.
Rate of climb (830 h.p.)	4450 ft./min.
Landing speed (with flaps)	64 m.p.h.

NATIONAL AIR RACES

(*Continued from page 76*)

gain first place in the ATC races, drew praise for its splendid lines. The wing is not only filletted into the fuselage at the rear, but also into the nose of the fuselage where the blending is particularly graceful. In a single-engined job, leading edge filleting may be more important than rear-edge filleting.

In addition to the NACA cowling, the Seversky Amphibion was equipped with a new type of second cowling, with a second circular opening round the fuselage. We were informed that this pseudo-cowling had a perceptible effect on the speed of this airplane.

Some Suggested Ideas

The Ryan two-seater, an entry in the ATC event was one of the few commercial ships with an all-metal, metal-covered fuselage, and it lies in the moderate priced class. The construction embodies large long sheets, of rather thick skin and easy curvature, with very few bulkheads and stringers. It is possible to conjecture that monocoque fuselage construction can be employed in a moderate priced airplane without prohibitive cost, and with the gaining of many advantages.

Excitement by speed in racing can not be maintained indefinitely. The take-off and landings over a light barrier were a welcome change. More events of a similar character should be introduced.

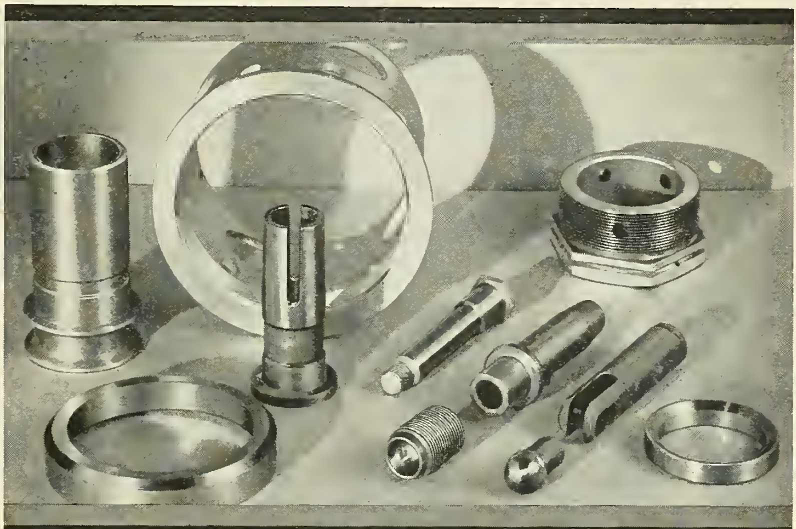
The formation flights, the daring tactics of the Army and Marine pilots were as thrilling as ever. We could however, take a leaf from British practice at Hendon and introduce some set military event such as the destruction of a cardboard village.

We must have aerial acrobatics, or aerobatics, at any race. But their return in thrills diminishes with the years. We seem to remember that both in France and Germany there are contests in aerobatics with definite points for the accuracy and neatness of certain maneuvers. Similar contests would enhance interest to a greater extent, particularly if well-explained. With experience and persistence it is possible to follow aerial maneuvers, but to many onlookers they remain rather puzzling and even meaningless.

A Refueling Act

Would not an exhibition such as refueling in the air be worth while seeing? Few of even the aviation crowd have witnessed this exploit.

We did note such novel exploits as the bat glide prior to the opening of the parachute, the sky writing of 1935, etc., but some further constructive ideas on the above lines might not be out of place in National Air Races in the future.



PRECISION AIRCRAFT ENGINE PARTS

A personnel with years of experience in the aircraft industry and plant facilities devoted specifically to the production of parts of more than ordinary accuracy, combine to make Ex-Cell-O your most logical source for parts in which there must be no compromise with accuracy, finish, and inherent dependability.

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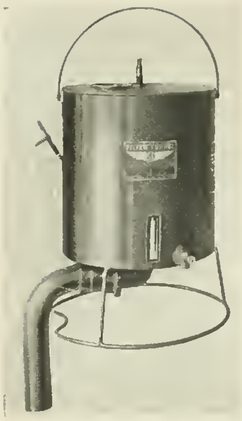
EQUIPMENT and METHODS



Filter - funnel designed especially for aviation use

Fueling Pit and Filter-Funnel

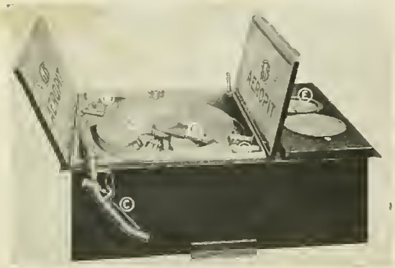
• MODERN AIRPORTS require modern fueling equipment. Among the essentials are reliability, safety of operation, avoidance of fire hazard, speed of delivery, and quick and easy operation. The Gilbert & Barker Aeropit has been designed to meet these requirements.

It is built of heavy gauge steel plate, with welded seams and flanged covers. The pit body has an outside coating of coal tar preservative to guard against corrosion, while the interior is finished in aluminum. Inside dimensions are 55 in. × 37 in. × 18 in.

Coiled around a ball-bearing turntable is a 50-ft. wear-resisting hose equipped with a spring cap fitting over the end of the nozzle to keep it clean. Chafing of the hose is prevented by a roller bearing guide. Fuel is pumped from the tank by a steel-housed pumping unit, powered by a 2 h.p. motor. A strainer frees the fuel from foreign matter.

When closed, the pit covers are practically flush with the ground. A pit depth of 18 in. not only makes for easy installation, but lessens accumulation of fumes in the bottom. If water should get into the pit, it can be removed by a hand pump.

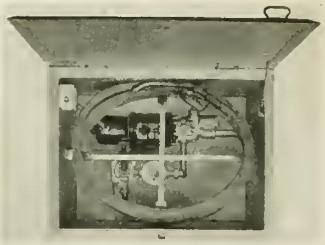
Normal delivery of the pit is 20-30 gal. per min. The mechanic partially opens the covers, inserts the hose guide in the side of the pit nearest the plane, touches the motor switch pedal with his foot, picks up the nozzle and walks over to the ship, trailing the hose. At the tank, he grips the nozzle control, and fuel flows immediately. The length of the hose gives a fueling range of almost 100 ft.



Fueling pit. A—Turntable. B—Pedal pump control switch. C—Nozzle. D—Clean-out pump. E—Dial. F—Hose recoiling rachet

A displacement type meter is used to record individual deliveries on a dial which is calibrated from 0 to 100 gallons.

For small airports and intermediate landing fields the company has developed a smaller pit. This unit has one compartment containing the complete pumping, measuring and filtering mechanism, as well as holding 50 ft. of hose. It is built similarly to the Aeropit and measures 40 in. × 30 in. × 26 in.



Fueling pit for small airports

The Filter-Funnel is made especially for aviation fueling service to assure clean, pure fuel. A glass gauge shows the presence of water, sediment or dirt and there is a quick-drain petcock in the reservoir. The filter uses a quick shut-off valve on top to prevent fuel waste, and the filter unit is easily and quickly removable for cleaning. An extra 1¼ in. nozzle for small tank openings is provided as standard equipment.

Single-Contact Lamp Socket

• G-M LABORATORIES, Inc., Chicago, Ill., have produced a bayonet-type, single contact lamp socket which is suitable, among other things, for scientific and industrial instruments, in devices where a long-life socket is required, and for high wattage lamps which are mounted in a confined space where temperature rise is great.

Insulating parts are of bakelite, and the contact pressure is produced by a helical spring which remains constant under all operating conditions. Connection to the center contact is made by a cadmium-plated spring clip which can be soldered if desired. Low contact resistance is maintained at the center contact, preventing the soldered connection at the lamp base from melting. This socket is made to close specifications on the inside diameter insuring accurate alignment of the lamp.

Stainless Steel Bar Stock

• JESSOP STEEL CO., Washington, Pa., has developed a composite stainless steel bar stock known as *Silverbond* for use in applications where the surface of the bar must have corrosion-and temperature-resisting properties.

The product is described as being a web-like structure in which low carbon inexpensive inserts to the extent of approximately 40% are mechanically held, as well as welded by pressure applied at high temperatures, so that there is no possibility of separation of the component parts. The cladding can be varied from 10% to 25% depending upon the application.

Stock is made in round, flat, octagon, hexigon, sheet, strip, and other shapes.

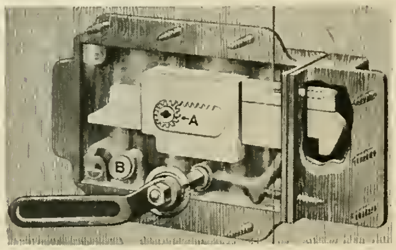
Locks For Sliding Doors

• A DEVICE which can be used to lock hangar and other sliding doors, is now being manufactured by the 20th Century Lock Co.

Known as the AM Springless Sliding Door Lock, it is so designed that no springs comprise its mechanism and no keys are necessary for latching or unlatching, action being automatic. Keys are used to lock or unlock the door.

Tamper and jimmy-proof, the lock consists of a horizontal steel bar equipped with teeth across its bottom which engage a pinion gear. When the key is turned, the dead bar holds the latch horizontal so that it cannot be raised from the strike. When the key is turned, the bar is moved by the gear, thus releasing the latch and permitting it to be raised above the strike.

Another means of locking which provides safety if keys are not at hand, is also available, the lock having a trigger which when raised prevents the latch from being disengaged from strike. This trigger is operated without turning the key cylinder.



Springless sliding door lock. A—Pinion gear. B—Trigger for lock

Automatic Control of Wind-Tees

• ACCURATE INDICATION of the wind direction is available through the use of a new system developed by Aircraft Service, Inc., Cleveland.

This unit which can be used with any existing wind-tee, provides automatic regulation by a controlling mechanism which keeps a large motor-driven indicator into the wind at all times. Through a delayed control, continuous movement of the indicator is prevented during gusty winds, and it remains headed into the true, average wind direction without oscillating or hunting.

When there is no wind, automatic control is interrupted and the tee may be swung to any heading which best accommodates the particular traffic needs of the airport at that time. The tee will remain in that heading until wind velocity picks up to a point where it is essential that it be pointed into the wind. Automatic control is then automatically resumed and the tee is brought to the proper heading.

Manual control of the tee at any time may be assumed by throwing a switch and continuing operations by push-buttons. If at any time manual control is accidentally left on and the large tee is out of the wind for more than a predetermined interval, attention is called to this fact by an audible alarm. This interval may be adjusted to suit the wishes of the airport management.

Automatic control circuits are simple and have been developed to a point where reliability is obtainable without complicated arrangements. Only one tube is used, a rectifier, which operates at a fraction of its rated output. Two meters are provided on the face of the control panel to indicate at a glance whether parts are properly adjusted and operating.

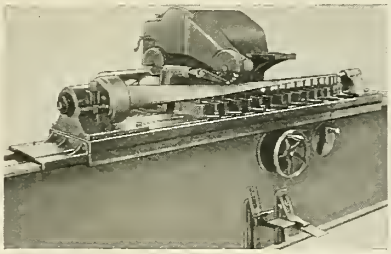
Full 360° sensitivity is accomplished and there is no multiplicity of contact points or dead-spots.

The system can be operated from commercial power lines if desired, or from unit power-plant supply where usual electric power lines are not available.

There are less than half a dozen parts in the control-head subject to wear. In addition, the company has developed a new airfoil type of controlling vane which provides smoother operation and gives greater protection to the control housing in sleet storms.

Propeller Profiler

• ENGINEERING AND Research Corp., Washington, D. C., has developed a propeller profiling machine which profiles one side of the blade at a time.



Front view of propeller profiling machine

The master cam (or form) is a solid piece of cast iron whose length is about 2 in. more than the maximum width of the blade being produced. The cam rotates and is directly geared and synchronized with the table holding the blade forging which is fed horizontally past the cutter. Thus each line radially on the master cam represents a corresponding element of the blade. The cutter with the roller or similar profile reciprocates fore and aft in simple harmonic motion and oscillates freely about a trunnion which permits the vertical travel necessary to the contour.

The blade is fed horizontally past the cutter from tip to hub. At about 18 in. from the hub the cutter lifts off the forging and the machine is automatically shut off. The table is then cranked back to the starting position by a hand wheel, a new forging is inserted, and the machine is started by a conveniently-located push button switch.

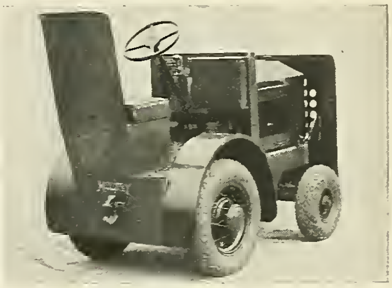
The propeller is supported on the table by a head and tail stock, the latter connection permitting horizontal expansion. Between the head and tail stocks are closely spaced and easily adjustable steady rests. The blade is held tightly against these by a weighted roller located ahead of the cutter to insure contact at the point being machined.

The cutter has a peripheral speed of about 5000 ft. per min., and can remove ⅜ in. of metal with one cut. The length of the stroke may be varied as well as its position relative to the center-line of the table, and the number of strokes per minute can be changed by using different sets of pulleys. V-belts and the horizontal feed may be changed or cut out by the operator while the machine is operating. Micrometer adjustments allow shifting the blade's center of gravity.

4-Wheeled Tractor and Trailer

• A NEW four-wheel (two wheel drive) medium duty gasoline tractor for airport use is being marketed by Mercury Manufacturing Co., Chicago, Ill. Known as the *Banty-Quad,* it is a compact and easily handled gas-powered machine, capable of hauling airplanes on the field or in hangars, as well as for baggage, express, and mail loaded on trailers. It is equipped with heavy-duty pneumatic tractor tires, permitting operation anywhere on the airport.

The unit weighs approximately 3,000 lbs., with overall length of 82 in., width of 47⅛ in., and an outside turning radius of 104 in. It delivers a maximum drawbar pull of 2300 lbs., at a speed of more than 3 m.p.h. Normal drawbar pull of 600 lbs. at a speed of 10¼ m.p.h., or a sustained drawbar pull of 90 lbs., in high gear at 8 m.p.h., covers the entire range of customary airport requirements, with the maximum available for any emergency.



"Banty-Quad" gas-powered tractor

Half inch steel plate bumpers front and rear are designed to protect the driver, and the radiator. Generator, battery, starting motor, and horn are standard equipment. Any type of coupler or hitch required for hauling trailers, or for other work, can be provided, mounted on the rear of the frame.

The company has also developed a spring suspended platform truck, especially adapted for handling baggage, mail and express. It is a wagon type, fifth-wheel steer trailer with semi-elliptic springs both front and rear, and heavy welded steel frame construction.

Tires are heavy duty type, and with the spring suspension make an unusually easy riding truck, even over rough roadways and at high speeds. Timken roller bearings are used in the wheel hubs, and Alemite fittings are provided for convenient lubrication.

Mercury platform trailer

Personairlities

By Caldwell

● The great economic problem of the century is to strike a balance between production and consumption; we have too many producers, too few consumers. Noticing this at an early age, L. A. "Jack" Vilas, now manager of the Aviation Department of the Pyle-National Co., decided to become a consumer. In this wise decision he was aided by the fact that his father was thoughtful enough to become president of the New York Air Brake Co., and later to organize the Pyle-National Electric Headlight Co., now the Pyle-National Co., thus collecting a large bag of what Mr. Damon Runyon refers to as potatoes. On these financial goobers Jack Vilas has lived a happy and useful life, avoiding all hard labor like a sensible man, and leaving the business of production to those less fortunate. I have never quite forgiven my own father for his carelessness in failing to provide me with a bag of potatoes on which I could coast through life.

Jack Vilas was born in New York City, May 25, 1891, the seventh child of a family of eight. When Jack was a boy they still used horse cars in the city, and the elevated trains were pulled by steam locomotives, which were finally done away with because the engines made so much smoke that passengers couldn't see into the third story windows. To-day the modern New York child can ride the Elevated and learn the essential facts of life.

When he was still a lad Jack's family moved to Chicago, and he grew up there during the pre-machine-gun age, taking trips to the Thousand Islands, Cape Cod, Florida, Wisconsin and other places on fishing and hunting trips. He gradually became quite a sportsman and an excellent shot. During this period his family tried to have Jack inoculated with an education, but it didn't take. He attended the Asheville School for Boys at Asheville, N. C. where he went in for trap-shooting, boating, hunting, and riding horses. He hunted and shot his way through that school, went to Wisconsin and hunted some more. There were still great stretches of virgin timber in northern Wisconsin in those days, so a few of the animals hid behind trees and escaped. In between shooting forays Jack went in for automobile racing and motor-boat racing, until it suddenly occurred to the family that perhaps Jack should start in to become a producer. So they chucked him into the Pyle-National Co. at $6.70 a week. He lasted about eight weeks when he asked for two weeks' vacation. At the end of the two weeks he wired for an extension, and his brother, who was president, wired right back for him to stay away as long as he cared to. He stayed away about twenty years.

With this background it was perhaps inevitable that he should end up in aviation. In the fall of 1912 he and a friend went out to old Cicero Field and paid Max Lillie $25 apiece for a ride in a Wright Model B, with two propellers and warping wings for lateral control. (Lillie was killed two years later.) Jack Vilas decided to enroll in the Curtiss Flying School at Hammondsport, and in April, 1913, reported for instruction and met Mr. Curtiss. The first thing he did was to order a new $6,000 Curtiss flying boat. Mr. Curtiss asked him how he knew that he was going to like flying, and Jack said he didn't know whether he would but he thought he might as well buy an airplane.

Early Bird Jack Vilas

Doc Wildeman was in charge of flying boat instruction, and a standard hydro class was under Lannie Callan. Doc Wildeman took Vilas up for his first instruction, which consisted of flights of about ten or fifteen minutes. On days when flying conditions were bad Jack would work all day in the factory, helping to build his own machine. Mr. Curtiss was too smart to pay him for that, of course. When Doc Wildeman left the school for a few weeks, Beckwith Havens took over the instruction. Up to that time Jack hadn't gone solo, but was about ready to be turned loose when his new machine was finished and brought down to the lake and set up. Mr. Curtiss tested it himself and then let Jack take it out, with strict instructions only to run it on the water and not take it in the air. Jack started off to familiarize himself with it on the water, and was skimming along, as happy as a clam, when he suddenly noticed that he had left the lake behind and was sailing along about 150 feet above it. He then felt like a clam that had been lifted aloft by a hungry sea gull to be dropped and cracked up. He pushed forward on the control column, but the boat went on up, paying no attention to him. He pushed further forward until he was nearly out of the shoulder yokes, with the controls at arm's length, and still the machine was not taking the proper gliding angle. He stretched and stretched and had the controls down under the cowl and the motor throttled before the ship started to glide steep enough to give him speed for a good landing. He was greatly relieved when the boat touched water. It appeared that Jack didn't weigh enough to hold down the front of the boat, so they put several old motor-cycle flywheel castings in the nose, and then the machine flew perfectly.

After several more flights he tried for his Aero Club license, and was given Hydroaeroplane Pilot's Certificate No. 6, dated June 25, 1913. At Mr. Curtiss' request the boat was shipped to New York, in an express car, and placed on exhibition on the roof of the Hotel Astor. That was perhaps New York's first aircraft show, and certainly the first flying boat to be exhibited here—of course there had been airplanes and seaplanes before then. Jack made several flights around New York. The *Times* of June 23, 1913, says: "Mr. Vilas, who is only 26 years old, and who manages to struggle along on an income of $30,000 a year, is the first man to own and operate a flying boat." I don't

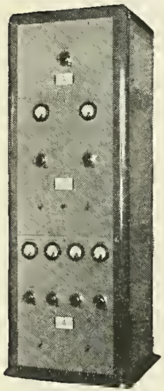
(*Continued on following page*)

Perpetually modern ...reliable...efficient

RCA

AIRPORT EQUIPMENT

RCA AVT-1A radio telephone traffic control transmitter, the basic instrument in airport equipment. May be used to energize an airport public address system as well as direct traffic.



RCA 125-watt equipment, consisting of the AVT-1A, plus the AVT-8 linear 100-watt amplifier, and the AVA-3 runway localizer, illustrating RCA flexibility and non-obsolescence.

When buying airport equipment, be sure that the instruments you purchase are not only modern now, but can be kept so at minimum expense. This important necessity is a feature of RCA equipment, which is so designed in coordinated units as to make expansion and modernization simple and economical.

For instance, it may well be that considerations of use and economy will lead you to believe that a radio telephone transmitter will be adequate. For this purpose we have the AVT-1A, especially designed for traffic control. An important feature is the provision for use of its audio system with loud speakers for paging, making announcements, etc., around the port.

When traffic grows and additional radio facilities are indicated, it is not necessary to dispose of AVT-1A. It may be retained, and AVT-8, a linear 100-watt amplifier, mounted upon it. On that may be placed the AVA-3, runway localizer. You then have a complete radio telephone-telegraph and beacon transmitter, offering traffic control, low ceiling approach and landing facilities and public address.

The RCA unit system not only permits you to acquire these facilities in steps, at low cost, but also provides for economical future changes to incorporate modern improvements when desired. We believe this to be the most satisfactory basis for airport equipment. For details, demonstration or purchase, address

AVIATION RADIO SECTION

RCA MANUFACTURING COMPANY, INC.
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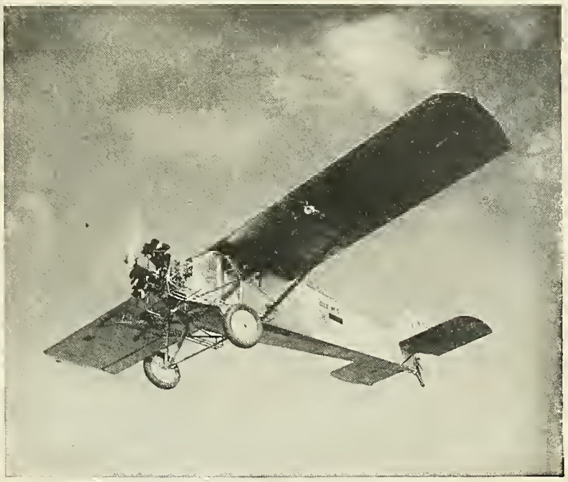

The "Ole Miss" on her record-making flight

The Wings of "Ole Miss" were covered with

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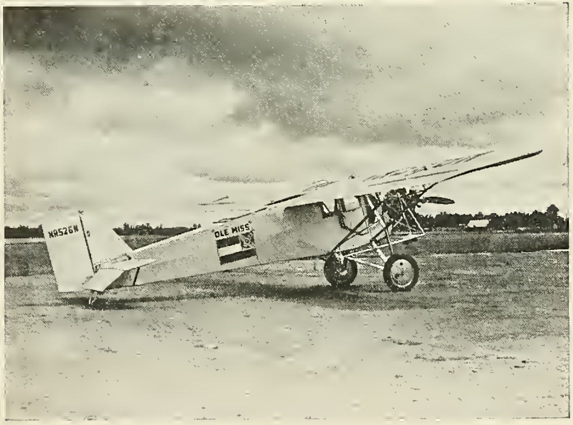
With many makes of wing-covering fabric to choose from, the Key Brothers on their own initiative installed B*A* 30 before going up on their record-making flight.

They selected B*A* 30 because *they knew it could be depended upon.*

A self-imposed weight maximum of 4 oz. to the square yard with a size content not to exceed 1 per cent. No starch or sizing. In BA-30 you get *all* cotton.

The "Ole Miss" after making a record of 653 hours in the air.



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(*Continued from preceding page*)

know whether that statement is strictly accurate or not—you can't always believe reporters—but Jack is surely one of the first of the Sportsmen Pilots. He is also the first man to fly across Lake Michigan, from St. Joseph, Michigan, to Chicago, a distance of about 60 miles, in 85 minutes. He made that flight July 1, 1913, and it caused more comment than a transatlantic flight would to-day. He even had a passenger, a brave young man named Billy Bastar who thus goes down in history as the first to fly across Lake Michigan.

The following year Jack bought a new flying boat—he was a God-send to Glenn Curtiss. It was christened the L.A.V. II, and Jack flew it for three years. He took the first moving pictures of Chicago ever taken in flight, about July, 1914. Another first of his was spotting a dead body floating in Lake Michigan. He landed and was going to take it aboard when he noticed that it must have been quite some time since that body had moved around under its own motive power. So he got a rope and towed it slowly to the beach. Nobody thanked him for retrieving it. That was Aug. 10, 1914, and even at that time citizens of Chicago were in the habit of casually tossing each other's remains into the Lake.

Up in Wisconsin in the summer of 1915, where he'd gone to see if he'd overlooked any animals in his boyhood, it occurred to Jack that a flying boat could be used to spot forest fires, so he mentioned the subject to the State Head Forester, who was enthusiastic about the idea. He appointed Jack a Fire Warden—at no pay. The *Literary Digest* of Oct. 2, 1915, gives him credit for being the first flying Fire Warden, and he even discovered a few fires.

Back in Sept., 1913, Jack had taken unto himself a wife and had started to collect a family—he has three children, Ariel, Jack, and Sue, and is a devoted father. Mrs. Vilas seems to have endured considerable suffering, according to accounts of various hunting trips on which Jack dragged her, and which he has recounted in an interesting book he has written for his children and for private circulation among his friends. On one occasion she left Chicago for the woods without getting a fall hat, so Jack went right out and shot one for her. That is, he shot a small sea gull, cured the wings, and made it into a hat. He still labors under the impression that it was the most attractive hat she ever had! On another occasion, after shooting all the quail in sight, he shot Mrs. Vilas—he was just naturally a persistent shooter. Of this incident he says in his book:

"Your mother and I were somewhat apart and out of sight of each other among dead weeds higher than our heads, when I kicked a bird up under my feet. Thinking your mother was in a different direction, I shot at the bird. Just as I shot I heard your mother cry out: 'You shot me!' I dropped my gun and ran over to where she was. I was quite frightened for a few seconds until she showed me one shot mark through her shirt right in the center of her chest. I tore her shirt open, and sure enough there was one shot imbedded just under the skin. I took out my knife, made a little incision and took the shot out. I was thankful that the accident wasn't any more serious." That ought to be a lesson to young women who go and marry sportsmen pilots. On another day he shot himself, taking a chunk out of his finger when the gun accidentally went off. Of course, this shooting was taken as a matter of course by that Chicago family. All of the children are excellent shots, and may be counted upon to shoot their way out of any social events in Chicago.

Oddly enough when the war came along Jack got no chance to do any shooting, because he joined the Navy and was sent to Great Lakes Station where they had four ground schools but no flight instruction school, though they did have a few planes to fly around with. Here Jack spent the months very quietly, and as he had a house in Highland Park he was able to live at home and commute to the war. If the Germans had got across and had attacked Great Lakes Station, I have no doubt that it would have gone hard with them—they'd have been picking bird shot out of themselves for days and days afterwards. After the war was over the Navy invited Jack to stay along with them, but he said he had to get back to his hunting, as the wild life of the country had been getting ahead too much with him off to the war, and all. The first thing he did was to go down to Arkansas and shoot 46 wild geese—that showed them where *they* got off, honking at Naval aviators.

Then, still hungering for excitement, Jack joined the Ku Klux Klan—I didn't know before that anyone over fourteen years of age ever had belonged to that outfit. Once a gang of them put on their nightgowns and went to clean up a group of moonshiners, and a moonshiner shot a Kluxer—that tickled me most to death when I read about it in Jack's book, for if there's one animal more than another that's fair game for a sportsman it's a Ku Kluxer. Of course, Jack was just in it for the fun of the thing; when the hunting season closed he threw away his nightgown and got back into pajamas. Now he tells me that he's manager of the Aviation Department of Pyle-National, but naturally I don't take him seriously. He can't make me believe that a good old Consumer is going to turn around and go Producer on us. Yet a disturbing thought enters my mind—has it come to a point where he has slaughtered all the game and is driven to work, in desperation for something to do? Well, it seems to be open season for Dictators—and I wouldn't miss either Mussolini or Hitler. That's just a suggestion.

Clinical Notes

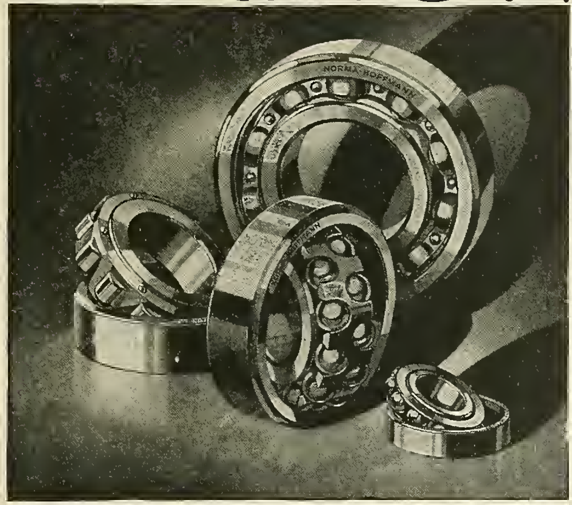
I wonder what has happened to my old friend, Charles Grey Grey, Editor of the *Aeroplane*, of London. The dear old boy, after printing a large gob of misinformation about American airlines in the *Aeroplane* of May 1, has failed to reply to my mild rebuttal, in the June and July issues of AERO DIGEST, and also has failed to publish the correct speeds of our airlines, which I supplied to him.

As matters now stand, C. G. G. is in the unfortunate spot of having misled his readers with obsolete figures, taken from old inventory lists, and of not being willing to inform them rightly. Furthermore, he not only has betrayed his own readers, who look to him for the truth about aviation matters, but also has placed himself in the uncomfortable position of having attacked the aviation industry of a friendly nation. When that attack was gently countered, he fled ignominiously and took refuge in silence. English readers of the *Aeroplane* must read AERO DIGEST if they would know the truth about American airlines.

One of our London readers, a gentleman of standing in British aviation, writes: "I have derived considerable pleasure from your articles in AERO DIGEST on the so-called Airway Bluff and, strange to say, I am entirely on your side. Perhaps you do not realize the stir that your articles have caused over here. The aircraft trade through its representative body, the Society of British Aircraft Constructors, addressed a very curt note to the Managing Director of Temple Press, Ltd., pointing out that it will not tolerate much longer the sight of C.G. trailing high-smelling ruddy herrings across anybody's path, but more particularly yours, and many firms acted individually and administered their own raspberries."

Be that as it may, the *Aeroplane* has erred and should make amends by publishing a correction occupying at least as much space as the original comedy of errors. It seems to me that the honorable Society of British Aircraft Constructors, keen to show that sense of fair play for which the English are noted, should themselves suggest in another very curt note to the Managing Director of Temple Press, Ltd., that the Editor publish the brief and accurate analysis of American airline speeds with which I have, out of friendship, supplied him. Let not the murkiness of the Grey mythology continue to darken the minds of English readers of the *Aeroplane*, many of whom are not fortunate enough to bask in the bright light of reason and modern information, which ever shines with rare effulgence from the kindly pages of AERO DIGEST, *the* magazine of the air.

PRECISION



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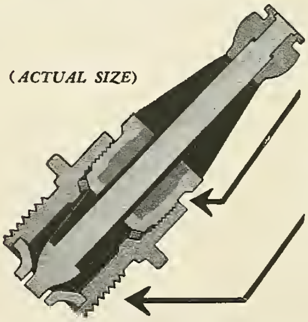

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AIRLINES AND AIR TRAVELS

July Traffic At New Peak

A NEW all-time record for passengers carried in a month was set by scheduled airlines operating within the borders of the United States in July. Reports to the Bureau of Air Commerce, Department of Commerce, disclosed that these lines carried 85,193 passengers that month.

The previous record had stood for only one month. The 73,896 passengers carried in June constituted an all-time record until it was bettered in July.

From the standpoint of passenger miles flown, the airlines set a new record in July for the fifth successive month. Passenger miles (one passenger flown one mile) in July 34,040,925.

The monthly figures cover all domestic airlines, but do not include extensions to foreign countries. The domestic lines flew 5,591,559 miles, carried 297,509 pounds of express, and flew 173,452,532 express pound miles in July. Express poundage in July was less than in June.

Further gains in traffic are evidenced in reports from General Air Express which reported increases in its business for the first six months of 1935 over the same period of 1934. For the entire system, poundage and number of shipments showed increases of 51.1% and 74.4% respectively. Revenue increased 62.2%.

United Air Lines gained 20.2% in passenger carriage for the first seven months of 1935 as compared with the same period of last year, and 47% increase in express for the same period. W. A. Patterson, president, expects these records to be bettered for the remainder of the year.

Northwest Airlines reported that passenger traffic between Chicago, the Twin Cities, Spokane and Seattle increased 125% over the first seven months of 1934. A gain of 80% was also shown for the year in passenger miles flown. Mileage totals for the period ending June 30, 1935 was 6,842,100 passenger miles, as compared with 3,866,500 passenger miles in the fiscal year ending June 30, 1934.

The volume of air mail dispatched at the St. Louis Post Office in August, as compared with the corresponding month last year, increased 3215 pounds or 53.6%. There was an increase of 3669 pounds, or 61.3%, in the air mail received in the same period. The total volume of air mail dispatched was 9212 pounds, compared with 5997 pounds in August, 1934. St. Louis received 9643 pounds, compared with 5974 pounds in August, 1934.

Passenger traffic on Chicago & Southern Airlines operated between New Orleans and Chicago, has shown a 40% increase during August over July according to Tom Lemly, Jr., Memphis traffic manager.

Continuing its consistent record of gains made in passenger traffic over last year on the Washington-Detroit-Milwaukee route, Pennsylvania Airlines & Transport Co. announced through W. J. Austin, vice-president, that again in August an increase to the extent of 152% was noted over 1934 figures for the same period. Taking the first eight months of 1934 and 1935 into consideration, traffic for the current year is almost 200% ahead of last on this line.

In August, for the third consecutive month, United Air Lines carried an average of 20,000 revenue passengers monthly. United's summer traffic was substantially ahead of the same period last year. United points to a high performance record with the Boeings as in the last quarter United flew 99.2% of 4,500,000 miles scheduled, all with passengers.

National Parks Begins Eighth Year

HAVING FLOWN more than 4,000,000 miles since commencement of service, August 1, 1928, National Parks Airways, Inc., began its eighth year of air mail, passenger and express operations with record business, according to Alfred Frank, president of the system.

Outstanding developments which have featured the past year of operations, Mr. Frank reports, include the addition of Idaho Falls and West Yellowstone to the NPA line, the inauguration of a second schedule of service between Salt Lake City and Butte, Montana, in addition to the regular flight between Salt Lake City and Great Falls, Montana, and the placing of Boeing twin-engined, ten-passenger transports into operation over the route.

New Company Operating

COLUMBIA AIRLINES inaugurated passenger and express service last month between St. Louis and Cincinnati. The new airline, essentially a "feeder" service will make connections with Eastern Airlines and American Airlines in Louisville, Ky., and American Airlines in Cincinnati. At the latter city the St. Louis planes will also connect with Columbia Airlines' planes for Detroit, Mich.

Edward G. Bern is president of Columbia Airlines. Curtiss-Steinberg Field, East St. Louis, Ill., is the western terminal, operations and maintenance headquarters for the company. The schedule includes one westbound and one eastbound plane between St. Louis and Cincinnati. Five Stinson tri-motored airplanes are in service.

Personnel Changes

THE APPOINTMENT of Charles E. Beard as General Traffic Manager, replacing Nicholas Craig, resigned, has been announced by T. E. Braniff, president of Braniff Airways. Mr. Beard, who will maintain his office in the Braniff Building, Oklahoma City, was formerly passenger traffic manager for Northwest Airways; was in charge of the Air Passenger Bureau in the Palmer House at Chicago and more recently did sales development work for the Goodyear Tire and Rubber Co.

R. S. Knowleson, formerly with the Kansas City Star, has been appointed public relations manager of Transcontinental and Western Air, Inc., at Kansas City, and Northwest Airlines, Inc., announced the appointment of R. J. Babcock of New York City as Eastern Traffic Manager, with offices at 45 Vanderbilt Avenue.

Paul R. Braniff resigned as general manager of Braniff Airways, Inc., and Goodrich K. Murphy rejoined the traffic department of the New Haven railroad, following his resignation from Eastern Airlines.

The appointment of F. F. Vonnegut as district traffic manager for the Chicago District was announced by Rogers Humphreys, general traffic manager of Chicago and Southern Air Lines, as well as the transfer to Jackson, Miss., of D. H. Rotroff, district traffic manager, from the Chicago district. In addition H. L. Beynon has been made traffic agent in St. Louis for the company.

New Company Joins Express Chain

AIR EXPRESS service is now available over the route flown by Watertown Airways, Inc., following inauguration of service by the new company between St. Paul-Minneapolis, Willmar, Minn., Watertown, Huron, Pierre, Philip, Rapid City, and Spearfish, S. D. The company joined the Air Express Division of the Railway Express Agency and at present provides tri-weekly round trips between the cities on its route. Connections are made with Northwest Airlines at the Twin Cities, and with Hanford Airlines at Huron.

Schedule Revisions

TRANSCONTINENTAL & Western Air, Inc., and Braniff Airways inaugurated a new fast service from St. Louis, Mo., to Dallas and Fort Worth, Texas, by way of Kansas City, Mo. The afternoon plane leaves St. Louis at 1:59 p.m.

United Air Lines inaugurated service on a regularly scheduled basis at the Allentown-Bethlehem Airport. Addition of the two cities to the airline system was marked with signal ceremony amidst the presence of leading business men of both cities.

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AT THE AIRPORTS

Government Funds For Airports

APPLICATIONS for funds to build airports in 41 cities in Mississippi through the WPA has been made, the applications representing government funds amounting to $957,022 with the sponsors contributing $98,934.

Salt Lake City municipal field will be improved soon with approval won on application for WPA project by local officials. The request calls for the spending of $239,036 for: 6,400 square yards of concrete paving, 400,000 square yards of oil mulch pavement and the installation of a tile drain system of 19,600 lineal feet.

Preliminary plans calling for more than $7,500,000 in airport construction in the southwest have been drafted by Moss Patterson, regional director. Patterson, president of the Oklahoma City Aviation Club, had plans for construction and improvement of 477 airports. These would include 56 in Arkansas, 80 in Louisiana, 97 in Missouri, 71 in Oklahoma and 173 in Texas. The program carried out last year by W. C. Lewis, United States Attorney, under the civil works administration, was held responsible for Oklahoma's 49 airports.

$1,198,968 has been allotted for work on the Municipal Airport of Baltimore. The use of this sum of money on the airport, may make it possible to complete the airport, which was started several years ago and on which the city has already spent, $3,124,609.97. The city still has available from an airport loan fund, $875,390 to continue operations. A list of items to complete the project includes a fill which would cost about $1,200,000. Other needed items include drainage and lighting facilities, runways, hangars and administration and office buildings.

Maynor Field at Tuscaloosa, Ala., will be equipped with new runways and a drainage system to be constructed with $15,830 in federal funds.

An allocation of $3,363,758 for possible use in development of the Newark, N. J. airport and in line with the policy of the Post Office Department to increase aviation facilities there has been approved. In connection with the allottment is a sponsors' contribution of $614,653 from Newark and Essex County. Present plans provide for the construction of three new runways, the longest 5,000 feet; for razing of three small hangars on the north side of the field and for construction of a large new hangar to replace the three.

New Airports Planned

COMPLETION OF the municipal airport at Muscle Shoals, Ala., is near with the announcement that Governor Bibb Graves has signed a bill passed by the legislature authorizing the town to sell the 240-acre site to the Tennessee Valley Authority. Originally started as a joint TVA-CWA project the TVA has agreed to finish building the airport with a provision that it was not to be used for commercial purposes.

The City Council of Van Wert, Ohio, has voted to purchase 100 acres for an airport, and a site for a municipal airport at Jonesboro, Ark., has been leased by the City Council.

A financing plan for the purchase at an estimated price of $30,000 of the proposed South Point (O.) site for a tri-state airport was adopted at a recent conference of civic representatives of Huntington, Ashland, Ironton and South Point.

The proportionate share of the cost of purchasing the land agreed upon is $20,000 for Lawrence County, Ohio, $6,600 for Huntington, and $3,400 for Ashland. Of the $20,000 total for Lawrence County, $5,000 would be required to be furnished by South Point.

Plans are now progressing for the construction of a new airport for the City of Macon, Ga. An appropriation from the government already has been allotted and the land will be provided by the city. This project is being sponsored by the Chamber of Commerce through John L. Morris, and its aviation committee. The field is being laid out with proposed runways 1,000 ft. wide and 4,000 ft. long, running East-West and North-South, and diagonally NE-SW.

The Jamestown, N. Y., City Council adopted a project calling for the construction of an airport on the North Main Street field at a cost of $314,745.93, which includes $12,050 for the purchase of the land. The action is conditionary that the city is not obliged to purchase the land if federal authorities do not grant the funds. On the other hand, the federal government would not grant the funds unless the city has title to the property. To cover this condition, the city has taken options on the site, which contains 216 acres. The purchase of the land is to be consummated if the federal authorities approve the project.

Airport Improvements

BECAUSE OF general business improvements and the need for additional space, Midwest Airways, Inc., has leased Hangar #2 at the Milwaukee County Airport. Extensive remodeling is now being done, consisting of building a dope room, and private offices, and two classrooms.

A number of improvements at Raven Rock airport, Portsmouth, Ohio, have been started by Liming Flying Service, which recently took a year's lease on the airport from the city. Improvements include painting the hangar, refinishing the inside, and repairing and repainting the field markers.

A new depot is now under construction at the Idaho Falls Airport. It is a natural log two-story-and-basement building measuring 30 ft. × 50 ft. Rest rooms equipped with all facilities, including hot and cold showers compartments will be located in the basement. Attractively decorated, a fine waiting room will be constructed on the ground floor of the new log depot. The second floor, to be divided into two rooms, will house the government radio station. Towers will be constructed at both ends of the depot, one tower for weather observation, the other for use by the director of the airport. Built on the second story level, a special observation porch is to extend around the building. In addition to the depot, a hangar, measuring 70 × 120 ft., will be completed by early summer.

Weather reporting teletype and broadcast service will be installed at the Wayne County Airport.

Rhode Island State Airport serving Providence, R. I., is now nearing completion. This is a PWA job totalling approximately $500,000. Plans and specifications were prepared by A. P. Taliaferro, Jr. & Company, Inc., New York City, and the same concern is supervising the actual construction. Three concrete runways 3000 ft. long and 150 ft. wide and an apron of the same material 150 ft. wide and 1400 ft. long have been laid down. Altogether the runways and apron will contain over 175,000 square yards of reinforced concrete. The field has been graded and over $50,000 was spent on a drainage system. A novel feature of the drainage system provides, by means of flap and gate valves in the main drain lines, for backing up the water in the dry season of the year so that occasional showers can be held long enough to allow the roots of the grass to obtain their needed moisture.

The lighting system will include the usual beacon, lighted wind-tee, obstruction, boundary and two banks of flood lights, one at the north and the other at the south side. In addition, apron and runways will be equipped with flush type lights spaced, in the case of runways 100 ft. apart at each edge of the runways. All of the various phases of the complete system are controlled from the Administration Building and may be turned off or on as conditions require. The cost of the lighting installation is approximately $40,000.

Managers Meet In Birmingham

AIRPORT MANAGERS and non-scheduled operators will convene October 4 and 5 in Birmingham, Ala., for consideration of mutual problems, exchange of ideas and study of the latest advances in the field of airports and miscellaneous aviation operations. This meeting has been called by the Aeronautical Chamber of Commerce of America, and will be held at the Thomas Jefferson Hotel.

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THE INDUSTRY IN GENERAL

Larger Factories Under Way

ACQUISITION OF adjacent property and extensive alterations and additions to the research laboratories and engineering buildings of The Zenith Carburetor Co., Bendix subsidiary in Detroit, Mich., have been announced by Herbert L. Sharlock, director of public relations of The Bendix Aviation Corp. The new buildings will directly adjoin Zenith buildings in the motor city. Mr. Sharlock stated that the addition to the research laboratories and engineering buildings will be two stories high and will have extensive basements.

Under the direction of Jack Hicklin, aviation chairman of the San Diego Chamber of Commerce, special plans are being laid for the dedication of the Consolidated Aircraft Corp.'s new factory which will be held at Lindbergh Field October 20th. The dedication will be preceded by a luncheon which will be followed by ceremonies in front of the Consolidated buildings. The new San Diego buildings of the Consolidated factory are considered to be the finest and most modern for aircraft manufacturing. It was expected that the transfer of personnel and machinery from the company's former home in Buffalo to their new quarters will be completed October 1, and that the plant will be in full operation this month on the construction of the military contract just received from the government.

Victor Manufacturing and Gasket Co., Chicago, recently enlarged its plant by acquiring a square block of land with buildings immediately adjoining its present plant. Part of the buildings have been converted into an asbestos mill designed to supply the requirements of the company. The operation made necessary the building of an approximately 750,000 cubic foot capacity warehouse for the storage of the raw asbestos fibre. The new plant also houses an enlarged laboratory as well as miscellaneous operations transferred from the main plant.

The Industrial Division of the S. S. White Dental Mfg. Co., which handles all of the industrial products manufactured by the company, including flexible shafts, flexible shaft driven machines, small cutting and grinding tools, molded resistors, etc., has moved its offices to new and larger quarters at 10 E. 40th St., New York City.

New Companies Formed

AERONAUTICAL RESEARCH Co., Boston, has been formed to furnish a complete aeronautical consulting service, particularly in the problems of airplane stability and control. The president of this company is Arthur G. B. Metcalf, associate professor of aeronautical engineering at Boston University. This company at present is developing and constructing a new-type airplane. Ames Aircraft Corp., Boston Municipal Airport, East Boston, Mass., is another company recently formed.

Organized by veteran aircraft men, the Gwinn Aircar Co., Inc., has begun work on an experimental plane to be known as the *Aircar*. The president of the new firm is Joseph M. Gwinn, former designer for Consolidated Aircraft Corp. Associated with him on the company's directorate are: Jack Sanderson, president of the Fleet Aircraft Corp., of Canada; Clinton P. Warner, Eastern representative of Consolidated Aircraft; John T. Nitterauer and O. Clyde Joslin.

Another new organization has been formed to specialize in the manufacture of precision electrical resistance instruments and allied products. Known as Tech Laboratories, the new company will be located in Jersey City, N. J.

One of the new Lockheed Electras under construction for Eastern Air Lines

Business Reports

CONSOLIDATED NET earnings of the Fairchild Aviation Corp., before provision for Federal taxes, for the six months ended June 30, 1935, amounted to $27,104 or 12 cents per share on the 220,466 shares of common stock of the corporation outstanding. Net sales for the period amounted to $520,129, compared with $597,432 for the corresponding period in 1934. On June 30, 1935, consolidated unfilled orders amounted to $1,302,634, compared with $535,854 at the same date last year, and $919,365 as of January 1, 1935.

Resumption of dividend payments on stock of Aluminum Industries, Inc., of Cincinnati, manufacturers of Permite products, was announced by treasurer and general manager H. J. Hater, following the semi-annual meeting of directors when they voted to put the stock on a 40 cent per annum basis and authorized a quarterly payment October 15, to stock of record, September 30. Business during July and August and that already booked for the remainder of the year, will exceed the volume for the same period last year appreciably.

Improved condition of the Lockheed Aircraft Corp., this year over last is reflected in the current financial report which shows that net sales for the first six months of 1935 amounted to $1,065,871, as compared with $562,759 during the entire year of 1934. The Lockheed report, issued by Robert E. Gross, president-treasurer, showed that operations resulted in a net profit, before Federal taxes, of $152,934 during the first half of this year, as compared with a net loss of $190,891 during 1934.

851 Aircraft Produced in Six Months

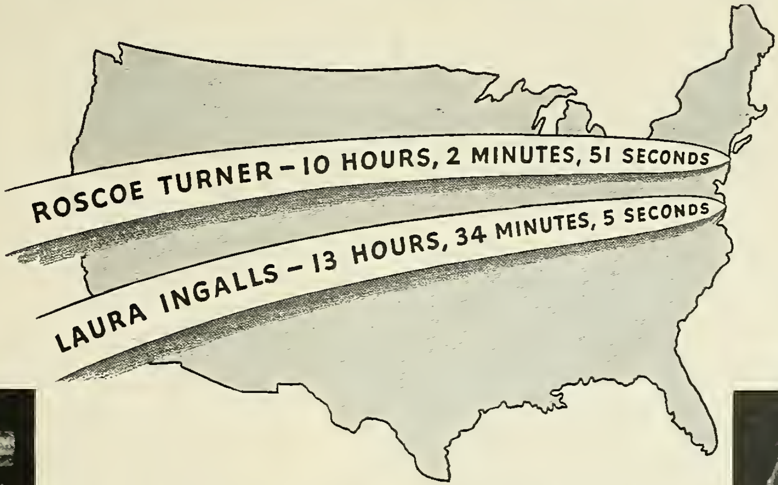
THE AERONAUTICS industry in the United States produced 851 airplanes in the first six months of 1935, a 14% increase over the corresponding period in 1934, according to the Bureau of Air Commerce.

This total included 517 aircraft for domestic civil use, 173 for military deliveries and 161 for export. Production for domestic civil use, and for export increased in the first half of 1935 over the first half of 1934; deliveries to the military services were less this year than last, for the corresponding six-months periods.

There were 81 companies and individuals who produced aircraft for domestic civil use during the six-months period. However, 82% of the civilian and commercial airplanes were built by 13 companies which produced five or more aircraft each.

(*Continued on following page*)

SUPERB PILOTING BACKED UP BY DEPENDABLE EQUIPMENT ENABLED THESE FLIERS TO SET NEW TRANSCONTINENTAL AIR RECORDS


ROSCOE TURNER—10 HOURS, 2 MINUTES, 51 SECONDS
LAURA INGALLS—13 HOURS, 34 MINUTES, 5 SECONDS

In both instances the planes were equipped with Bendix H-T Aircraft Spark Plugs and Scintilla Aircraft Magnetos.

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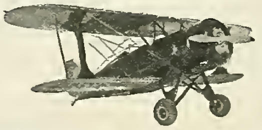

LAIRD Speedwing	Wasp Jr. 400
LAIRD Whirlwind	Wright J-6 300
LAIRD Whirlwind	Wright J-5 220
LAIRD Speedwing Jr.	Ranger 120
TRAVEL AIR 6000-B	Wright J-6 330
WHIRLWIND J6-9	330 h.p. engine
WHIRLWIND J6-5	165 h.p. engine

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(Continued from preceding page)

Distributors Appointed

AIR PARTS, Inc., Glendale, Calif., have purchased a quantity of Axelson parts and engines from Axelson Aircraft Co., and have taken over exclusive factory distributorship for these engines. With a steady increase of merchandise being carried, they are enlarging and remodeling their stock rooms.

Key Brothers are now distributors in the South of Rearwin airplanes. The new Rearwin Sportster is creating considerable interest and the Rearwin factory reports capacity production to take care of the orders received for this new model.

Raymond Aircraft Co., recently took over the distributorship of Beechcraft and Fairchild planes, and to better cover its territory, has made arrangements to operate from the municipal airport at Macon, Ga.

Midwest Airways, Madison, Wisc., has become distributors in the state of Wisconsin, for Exide aircraft batteries, Goodrich airplane tires and Berry Brothers finishes.

Approved Type Certificates

THE BUREAU of Air Commerce has awarded ATC certificates to the following:

Waco Aircraft Co., Troy, Ohio, model S3HD-A, a two place, open or closed land biplane powered by a P. & W. Wasp Jr. TB engine (420 h.p.).

Beech Aircraft Corp., Wichita, Kans., model B17L seaplane, 4- or 5-place cabin seaplane powered by a Jacobs L4 engine (225 h.p.) and equipped with Edo 3430 floats. This plane has the same load carrying qualities as a seaplane as the landplane version.

Wright Aeronautical Corp., Paterson, N. J., models Cyclone SR-1820F-54, and SGR-1820F-54, both 9-cylinder, radial, air-cooled engines rates respectively 700 h.p. at 2100 r.p.m. at 16,200 ft., and 685 h.p. at 2100 r.p.m. at 16.200 ft.

Arrow Aircraft & Motors Corp., Lincoln, Neb., model V-8F, 8 cylinder Vee, liquid-cooled rated 82 h.p. at 3,075 r.p.m.

Simplex Changes Name

THE SIMPLEX Piston Ring Co. of America, Inc., Cleveland, Ohio, has changed its name to Simplex Products Corp., the change being made in view of the expansion of the company during the past few years into the field of other related products in addition to piston rings, such as plain rings, piston resizers, piston pins, valve seals, brake lining, rear vision mirrors, and other products soon to be announced.

Camera Company Exhibits Product

THE SKYVIEW CAMERA CO., Cleveland Airport, whose exhibit of aerial and industrial photography was held during the National Air Races, report an unusual interest in the application of the Skyview camera to ground and aerial subjects.

Visitors to the National Air Races, including a number of prominent pilots and aircraft officials, were responsible for a large attendance at Skyview's quarters.

(Continued on following page)

Digest of Recent Events

Martin Bomber Seaplane Sets Three Records

BRIGADIER General Frank M. Andrews flew a Martin B-12 bombardment plane over the second lap of his 2,000-kilometer flight at an average speed of 165.4 miles an hour, breaking three world's records for the 1,000-kilometer course. General Andrews' elapsed time for the 1,000-kilometer course, flying with a 2,204.6-pound (2000 kilograms) load, was 3 hours 45 minutes 13 seconds. The general, commander of the General Headquarters Air Force, flew for the record over a triangular course on which the points were Willoughby Spit in Hampton Roads, Floyd Bennett Field, New York, and Bolling Field, Washington. AUG. 24

S-42 Completes Another Trans-Pacific Flight

FLYING THE 2,400 miles from Honolulu in 17 hours 26 minutes, Pan America's Clipper S-42 landed at Alameda to complete the first round-trip to Wake Island, nearly 5,000 miles away. The Clipper cut 1 hour 14 minutes off the best time of its two previous trips from Honolulu to California. The flight was another hop in the Clipper's exploratory journeys preparatory to establishment of a commercial airline to the Orient. Captain R. O. D. Sullivan said the plane flew at an average altitude of 8,300 feet. AUG. 28

Tomlinson Flies By Instruments In Long Hop

A SEVEN-HOUR flight from Newark, N. J., to Kansas City was logged by D. W. (Tommy) Tomlinson who said it was the longest "blind" flight ever made by a commercial plane. Windows of the cabin were covered before the take-off at Newark and were not removed until the Douglas plane arrived over the Kansas City airport. SEPT. 9

New Landplane Speed Record 351.79 M.P.H.

HOWARD HUGHES was credited with an official world's speed record for land planes of 351.79 miles an hour after he made four attempts to establish a new mark over a special course at the Irvine Ranch, near Santa Ana, Calif. The old landplane speed record of 314 miles an hour is held by a French flyer, Raymond Dematte. The speeds made by Hughes were 302, 346, 352, and 339 miles an hour. The second attempt, when he attained a speed of 346 miles an hour, was not allowed after judges reported he dived into the course. SEPT. 12

Ingalls Sets New Women's Coast Record

LAURA INGALLS flew to Floyd Bennett Field in her low-winged Lockheed monoplane 13 hours 34 minutes and 5 seconds after she had left Los Angeles to smash the cross-continent record held by Amelia Earhart and miss the men's non-stop record, now held by Frank Hawks, by 7 minutes and 5 seconds. Her flight broke Miss Earhart's non-stop record, set on August 25, 1932, by nearly five and one-half hours, and her speed record, set on July 8, 1932, by almost three and one-half hours. Her plane, a Lockheed Orion, powered by a supercharged standard Wasp engine, developing 550 horsepower, and equipped with a Hamilton Standard controllable-pitch propeller and Sperry gyropilot had fuel tanks of 640-gallon capacity, giving the craft a range of more than 4,000 miles. Its top speed was well in excess of 225 miles an hour, and it could cruise at 220. SEPT. 12

Seversky Sets Amphibion Speed Record In Own Craft

MAJ. ALEXANDER P. de Seversky bettered the world speed record for amphibion planes by 39 miles an hour at the Wayne County Airport when he flew his Cyclone-powered craft 230.03 miles an hour over a three-kilometer course. The old officially recognized mark was 191 miles an hour held by Lieut. E. G. Stone of the United States Coast Guard. Seversky's fastest lap was 235.96 miles an hour. He completed four laps to obtain the average. SEPT. 15

Air Train Flies 837 Miles Non-Stop

A WORLD record for a non-stop and distance flight by an air train was claimed when a plane and a glider flew to Koktehel, Crimea from Moscow, 837 miles, in ten hours. The plane was refueled by rubber tubes from gasoline tanks in the wings of the glider, and carried three men. The previous record also was made by a Soviet plane, which last year flew 607 miles. SEPT. 18

Poland Again Wins Bennett Balloon Race

FOR THE third successive year Poland won the James Gordon Bennett international balloon race. First place went to the *Polonia,* which landed 1,600 kilometers (993.6 miles) from Warsaw, the starting point. Another Polish balloon, the *Warsawa,* was second. The German balloon, *Erich Deku,* and the Belgian, the *Belgiqua,* are provisionally tied for third place, pending determination of the exact distance they covered before landing. The U. S. Navy bag, flown by Lieut. Raymond F. Tyler and navigated by Lieut, Howard P. Orville, finished ninth among thirteen starters. SEPT. 19

Italian Pilot Sets Six New Records

LIEUT. COL. Attilio Bisco captured six speed records with payload when he flew the Montecelio Airport closed course at 390 k.p.h. for 1000 kilometers with 2000 kilograms. This flight established new marks in the 500, 1000, and 2000 kilogram categories for the distance. Bisco flew the 2000-kilometer course at an average speed of 380 k.p.h. bettering the speed record with payload of 2000 kg. over this distance. SEPT. 23

Waitkus Flies To Ireland From New York City

A WASP-powered Lockheed Vega, called *Lituanica II* and piloted by Lt. Felix Waitkus, completed a successful trans-Atlantic flight from Floyd Bennett Field in New York to Ballinrobe, Ireland enroute to Kaunas, Lithuania. The pilot was in the air for 23 hours 15 minutes before being forced down by a rapidly diminishing fuel supply. The plane was equipped with a Sperry gyro-horizon and directional gyro, and a Lycoming - Smith controllable - pitch propeller in addition to a Westport radio compass. SEPT. 22

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New trails, new thrills await the most seasoned sportsman when EDO's bear his favorite ship to endless water airports. North—lakes and wooded solitude teeming with fish and game. South—the sunlit Spanish Main and golden coasts for recreation. All about—great cities bordering the water. No event is missed, no pleasure or business wish is lost by inconvenience when your ship is equipped with EDO Floats, interchangeable with wheel landing gear. Write for complete prices and details.

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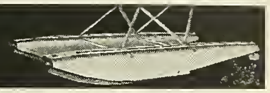

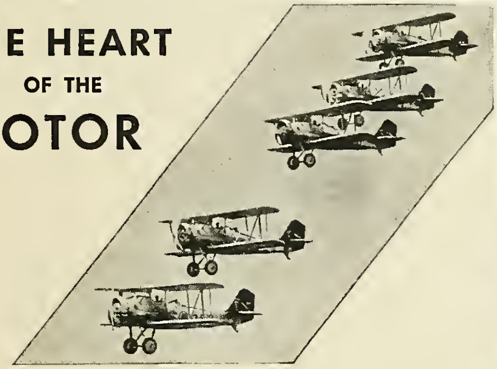

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The new EVANS E-9, latest development of the aircraft fuel pump, maintains correct gas pressure under all flying conditions. A sylphon relief valve assures constant pressure, regardless of the suction head, and a wabble pump can be used in conjunction without affecting the relief valve. The E-9 is a reliable, efficient, and foolproof heart for the motor.

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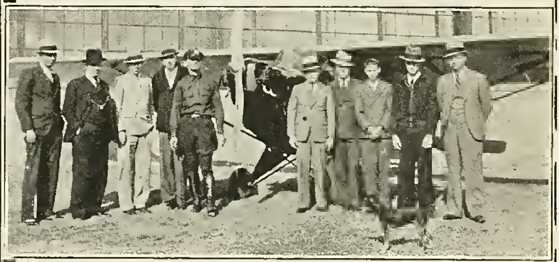

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L. L. RUPERT, manager of Muskogee Air Service bought his first CUB May 12, 1934. He says in part: "Within a week after arriving home with my CUB we had ten students signed and paid in advance. Next week five more. . . . They sure keep the CUB in the air . . . some days 7 and 8 hours. Students solo in 4½ hours (average). Some solo in 2¼, 2½ and 3 hours." Is the Cub sturdy and easy to keep up? Mr. Rupert says further: "We are still using the same propeller . . . and have the same air in the tires. Finish and covering on all surfaces are in A-1 condition. . . . We have never had a forced landing yet. . . ." Why wait? Get a CUB and start making money.

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AIRPLANE COMPANY, INC.

New Lambert Model 90A Monocoupe powered by a Lambert engine

(Continued from preceding page)

July Exports $912,893

AERONAUTICAL EXPORTS for July kept pace with those of the preceding month when the valuation of products reached $912,893 compared with $920,926 in June. Total value for the first seven months of the year was $8,853,532, more than half the total for the entire year 1934.

Sixteen planes and 43 engines brought $223,176 and $169,853 respectively, but the bulk of the total was made up from the sale of aircraft parts and accessories which brought $519,864. Brazilian purchasers took 5 planes worth $38,500 while three planes were sold in Chile, and two in Argentina. Sixteen engines were delivered in Russia; Mexico took five, and Peru and Panama three each. The largest amount of parts and accessories went to Netherland India, $113,216 representing the month's total with that country.

Other countries in which aircraft were sold included Poland, Canada, Mexico, the Union of South Africa, and the Philippine Islands. Engine sales were made in addition to the above in Poland, Trinidad, China and Hong Kong (2 each) and in Finland, Spain, Costa Rica, Guatemala, Cuba, Argentina, Venezuela and Japan (1 each).

Altogether American aeronautical of one kind or another were imported by 49 countries during July. Of a total military and commercial production of 597 units during the first six months of the year, 187 aircraft or more than 31 percent were exported; of the 1136 engines produced during the same period, 253 or more than 22 percent were for export.

Personnel Changes

COL. JOHN H. JOUETT has joined the aviation department of the Colonial Beacon Oil Company, Inc., according to Major E. E. Aldrin, manager of this department.

Col. Jouett, a graduate of West Point and a balloonist as well as an airplane pilot, learned to fly at Brooks and Kelly Fields, Texas. He went to China three years ago through the cooperation of the U. S. Department of Commerce to organize an aviation school at Shienchiao.

James R. Graham has been made Chicago manager for the Aero Insurance Underwriters of New York, to succeed Ralph J. Hall, who has gone to the Texas Company in the aviation department.

Aluminum Industries, Inc., of Cincinnati, manufacturers of Permite products, has appointed R. L. Corey as district sales representative for the states of Indiana, Illinois, Wisconsin, Iowa, Missouri and Minnesota. N. R. Patterson, for the last year affiliated with Permite, as sales engineer, will have his headquarters in the new Chicago office, along with Mr. Corey.

Alfred Smissen of Oklahoma City, has been named assistant sales manager of the export division of the Wiley Post Aircraft Corp., Oklahoma City, Okla. Smissen will open his sales campaign in Cuba, where he has worked for several years.

Joseph H. Douglas, formerly stationed in the Kansas City district, has been assigned to the Wichita, Kan., area as inspector for the Department of Commerce. He succeeded Max Goodnough, stationed at Wichita for the past year, who has been transferred to Washington and assigned as an airline inspector.

Charles Walker, formerly of the Los Angeles district, has been named inspector of the southwestern division. A. J. Milton Hamon has been appointed manager of the aviation sales department of Shell Eastern Petroleum Products with headquarters in New York. As assistant manager of the department since 1930, Hamon succeeds Maj. Gil Irvin, now with Seversky Aircraft.

Three women pilots have been appointed by the Bureau of Air Commerce, Department of Commerce, for the purpose of traveling throughout the country to assist cities in arranging for the marking of roof tops with signs to aid airmen in flight. They are Louise Thaden, Nancy Harkness and Helen McCloskey.

Timken Steel & Tube Co., Canton, Ohio, announces the election of Frank L. Gibbons as vice-president in charge of sales, and G. M. Hanrahan has accepted a position as assistant sales director of the technical division of the Algoma Plywood & Veneer Co., of which James R. Fitzpatrick is director. Hanrahan will have an office at the Detroit Leland Hotel, Detroit, Mich.

At the last meeting of the board of directors of Summerill Tubing Co., the following officers were elected: E. L. Parker continues as president; J. F. Boore was elected vice-president and George P. Kraemer was elected secretary and treasurer. N. H. Wolf continues as general manager and H. M. Brightman will continue as assistant to the president.

According to Caterpillar Tractor Co., Paul Weeks, for the past four years manager of its Washington office, succeeds Walter H. Gardner as manager of the Special Sales Division. Assisting Mr. Weeks will be C. L. McMulley, in charge of engine sales to manufacturers and G. E. Spain, in charge of power unit sales to distributors and engine dealers.

COMING EVENTS

The Soaring Society of America is sponsoring an expedition to the Big Meadows soaring site at Shenandoah National Park, near Luray, Va. Sept. 28-Oct. 18.

•

The annual air tour of Kansas will be held under the auspices of the Wichita Aviation Club. Oct. 2-5.

•

The Fourth Anniversary Celebration of the New Haven, Conn., airport will be held there, featured by a race and stunt program. Oct. 6.

•

The 1935 National Technical Meeting of the ASME will be held at the Hotel Chase, St. Louis, Mo., under the sponsorship of the St. Louis section of the ASME. Oct. 10-12.

•

Gladys O'Donnel is managing director of the Women's National Air Races and Pacific Air Pageant to be held at the Long Beach Municipal Airport. Nov. 10-11.

•

The Eighth Annual Miami All-American Air Maneuvers will be held at Miami, Fla. Dec. 12-14.

•

An International Aero Exhibition will be held in Stockholm, Sweden. May 15-June 1, 1936.

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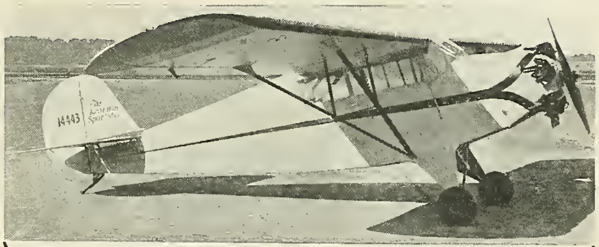

New Rearwin Sportster, Model 7000, A.T.C. 574

Key Bros. Select a Rearwin!

Preferred by Winners of Endurance Flight

KEY BROTHERS, of Mississippi, winners of the recent record-breaking endurance flight selected the Rearwin "Sportster" after careful, deliberate inspection of a large number of airplanes. This is indeed an outstanding indorsement of Rearwin design, Rearwin engineering skill and Rearwin quality. The new "Sportster" is a real achievement—Smart, Classy, Sporty—streamlined throughout. Dual controls; commodious, comfortable cabin; perfect visibility. 24-gallon fuel tanks in wings. 70-inch Hydraulic landing gear. 70 H.P. or 85 H.P. Leblond Motor. Costs a cent a mile to fly.

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FOREIGN NEWS IN BRIEF

Australasia

FIVE MULTI-ENGINED de Havilland airliners have been sold to Union Airways and Cook Strait Airways, two companies which will operate between New Zealand towns. Three D.H. 86 four-engined biplanes are required for the fleet of Union Airways, and two Dragon-Rapide twin-engined craft will work the services of Cook Strait Airways.

AUSTRALIAN Transcontinental Airways Ltd., with a capitalization of £500,000 has been incorporated to operate service between Adelaide and Sydney; Sydney and Melbourne, via Canberra; Melbourne to Adelaide; and Adelaide to Darwin, via Port Augusta or Maree, Oodnadatta, and Alice Springs, Tennents Creek and Pine Creek. It is planned to use 17-passenger Junkers planes over these routes.

AIRSPEED ENVOY twin-engined low wing monoplanes, able to carry up to eight passengers and 240 lbs. of baggage, have been purchased to operate new services between Japan and Manchuria. Powered with Siddeley or Wolseley engines, the plane cruises at 150 m.p.h., and attains a maximum speed of 175 m.p.h.

WEEKLY PASSENGER service is scheduled between Cairo and Larnaca, Cyprus, via Jerusalem, by Misr Airworks, which operates local services in Egypt. Four-engined deHavillands will be used. They are equipped with radio and other improvements and have provision for 11 passengers. Arrangements for the carriage of mails are also being made.

AN INTERNATIONAL Air Competition will be held at Cairo early in 1936 under the auspices of the Egyptian Aero Club. A committee chosen from representatives of the Aero Club, the Civil Aviation Section of the Ministry of Communications, the Royal School of Engineering and the Government-operated commercial airline Misr Airwork, Ltd. will have charge of arrangements.

Canada

THE WEBSTER Memorial Trophy for the best sportsman pilot in Canada was awarded to Gordon R. McGregor, representing the Kingston Flying Club, at Cartierville Airport, Montreal. Second and third places went to Flight Lieut. Roy Foss of the Montreal Light Aeroplane Club and to D. Nesbitt, also a member of the same club. Consolation prizes went to Wes Hodgson of the Regina Flying Club and to Fred Lasby of the Moose Jaw Club.

AIRCRAFT ARE now forbidden to fly over penitentiaries according to the terms of a new amendment to Canadian air regulations. The clause states that "No aircraft shall fly over any penitentiary in Canada, or over any prison or public institution or lands appertaining thereto as is pursuant to the Penitentiary Act . . . and no aircraft shall be used for the purpose of obtaining any information whatsoever in regard to these."

Central America

THE REPUBLIC of Cuba has just taken delivery of a Waco Model D to be used for advanced training. The ship has two bomb racks capable of carrying ten 25-lb. fragmentation bombs. Three machine guns are carried, one fixed in each of the lower wings, and one flexible in the rear cockpit. Instruments are provided in both cockpits so that the ship may be used for training as well as combat work.

THE PANAMANIAN Government recently granted Compania de Transportes Aereos permission to operate air service between Panama City and towns of the interior. The concession exempts the company from the payment of taxes, including import duties on materials brought into Panama for the operation of this service. In return the company is providing free transportation to the President of the Republic and Cabinet members on regular scheduled trips, and it also pledged to put its planes in the service of the government free of cost in cases of emergency.

Compania de Transportes Aereos is the third line operating between David and Panama City, the other two being Pan American Airways and National Air Transport Co.

France

A NEW law prohibits the creation of new airlines without prior permission from the Government. The decree has been presented to the Chamber of Deputies for ratification before January 1, 1936, and applies to France, Algiers, French colonies and countries under French mandata. It is the policy of the Government to coordinate transportation and limit competition. Previously no permission was needed to create and operate a commercial air service.

Great Britain

THE NEW de Havilland *Hornet Moth* is a two-place light cabin biplane which has been built to supersede the Moth open cockpit craft. Seats are wide and comfortable, and are arranged side-by-side. Behind them is a 14.5 cu. ft. baggage compartment. Beneath the instrument board is a shelf for maps and loose articles. Sliding windows provide ample ventilation. Both occupants have unrestricted visibility in all essential directions, and the view for landing is especially good.

Normal cruising speed, with a Gipsy *Major* 130 h.p. engine is 111 m.p.h. Fuel consumption is equivalent to 18.8 miles to the gallon.

THE AIR Ministry will place a sizeable order for the Avro 652A coastal reconnaissance monoplanes and material for the first batch of machines is being ordered. The new reconnaissance craft is a low-wing monoplane powered with two Siddeley *Cheetah* VI, supercharged, 290-320 h.p. radial engines. Landing gear struts and wheels are retractable within the engine nacelles, and long-chord ring cowls are installed.

WM. DOUGLAS Ltd., motorcycle manufacturers are to be absorbed by Aero Engines, Ltd., a company formed to take over the Douglas plant at Bristol for the production, under license, of the Hispano Suiza and the Monarch aircraft engines. Rights held by the new company are for the manufacture and sale throughout the British Empire of not only the present line of Hispano aircraft engines, both fluid and air-cooled, but for any new types that may be developed by the French company. The *Monarch* of General Aircrafts, Ltd., is a new side-valve, water-cooled 100 h.p. four-cylinder engine.

IMPERIAL AIRWAYS service from London to Australia has been improved by increasing the frequency of schedules between Calcutta and Singapore from once to twice a week. This change, effective late last month, follows similar improvement on the London-Calcutta section in January, 1935.

(*Continued on following page*)

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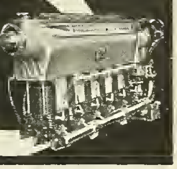

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(Continued from preceding page)

T. CAMPBELL Black, co-pilot with C. W. A. Scott in the *Comet* monoplane that won the MacRobertson Race is planning a series of record-breaking flights in a new, improved *Comet*. One of these is a round-trip England-Canada attempt which he plans to accomplish in little more than 24 hours.

TWO NEW models of the Avro 642 monoplane airliner, both considerably faster than their predecessors, were announced recently. One model, powered with two Siddeley *Panther* engines supercharged to give 560 h.p. at 6.000 ft., attains a maximum speed of 175 m.p.h., and the other model, with two *Panther* units supercharged to develop similar power at 12,000 ft., reaches 190 m.p.h. at 13.500 ft. Economical cruising speeds are 150 and 160 m.p.h. respectively. Each machine will carry 12 passengers and a crew of 2, in addition to 400 pounds of baggage, radio and other equipment. Normal cruising range is about 500 miles.

FOUR OF the new Bristol *Perseus* sleeve-valved engines will be placed in an Imperial Airways liner this year for exhaustive trials in regular service. More than a year has been spent in working out the "bugs" in this powerplant.

The engines will probably be installed in one of the Short *Scylla* biplanes flying the cross-Channel route. Comparative figures showing the actual performance of the *Scylla* with its estimated performance when *Perseus*-equipped show marked advantages for the sleeve-valved engines. Cruising speed should be eight m.p.h. higher.

THE SUPERCHARGED Bristol *Mercury* VI has completed official tests with a new controllable-pitch propeller being built under licence by the deHavilland company. Necessary modifications for the use of controllable pitch propellers are now embodied in the design of every Bristol engine in production.

POWER DEVELOPED by the *Tiger* VI, the latest model in the Siddeley Tiger range of fourteen-cylinder radial engines, goes up to 850 h.p., which is available for take-off at sea-level. Capacity of the engine is 1,996 cu. in., and it normally operates at 2,150 r.p.m. at which it produces 760 h.p. at 5,000 ft. Maximum power with the engine running at its maximum r.p.m. of 2,450 r.p.m., is 810 h.p., given at 6,400 ft.

FOURTEEN MONTHS development produced the Bristol *Pegasus* Series X engine, the first production group of which is ready for delivery in the autumn for installation in new types of aircraft. Full quantity production is scheduled for next spring since the engine has already been specified for a number of planes and orders have been received from continental countries for delivery next year. It will supplant in the Bristol range the *Pegasus* III which was put into production in the autumn of 1933.

Mercury-powered Bristol 142 converted into a high-speed bomber for the R.A.F.

The new engine is a moderately supercharged 9-cylinder radial air-cooled power plant which maintains full power up to 6,000 ft. Its net weight is 995 lbs. and power available for take-off at normal engine speed of 2,250 r.p.m. is 920, or 1.08 lbs./h.p. Maximum power output above 6,000 ft. is 875 h.p.

Mexico

COMPANIA AERONAVES de Mexico has applied to the Ministry of Communications and Public Works for permission to operate passenger, mail and express service between Mexico City and Neuvo Laredo, on the American border, with stops at four cities. This route was Mexico's first international airway, being inaugurated as a mail run by the government in 1928, but being abandoned when the Mexican Aviation Co. inaugurated service between Mexico City and Brownsville. The commission has also been asked for permission by Compania Transportes Aereos Chiapas which plans to operate a service between Tuxtla Gutierrez, Pichucalco and Salto de Agua, Chiapas state. The new route will amplify the company's service between Tuxtla Gutierrez, Pichucalco and Comitan.

South America

A NEW commercial airport for the city of Lima, owned and operated by the Airports Administration Co., is nearing completion. It will be used for scheduled air transportation, private flying and the Aero Club of Peru. The hangar cost $45,000, the terminal building $10,000, and unimproved real estate, $40,000. Another new airport at Huamachuco will be ready for use shortly, but its utilization will be restricted to an auxiliary classification planned for both military and civil use.

THE ARMY-OPERATED air mail service in the northern part of Brazil has been extended from Therezina and Fortaleza to Belem, capital of the state of Para. In addition service has been extended to include Floriano and Amarante in the State of Piauhy.

Spain

SERVICE WAS started between Barcelona and Valencia recently by Lineas Aereas Postales Espanolas and an extension from Valencia to Balearic Islands is planned shortly.

CONSIDERABLE INTEREST was shown by the Madrid press in the characteristics of the two twin-engined American transport planes purchased by the State-controlled and subsidized Lineas Aereas Postales Espanolas. One of these ships arrived at the Barajas National Airport near Madrid following a flight from Cherbourg by a Swiss pilot, accompanied by the chief pilot of the L.A.P.E. and a company engineer. The flight was made in 3 hours 40 minutes, the direct distance being 684 miles, or at an average speed of about 184 m.p.h.

A SPANISH-German air transport agreement has been signed, by which Spain authorizes Germany to establish an air service in Spanish territory, that is, on the Friedrichshafen-South American service with stops at Barcelona and Seville. Similarly, Germany granted a concession to a Spanish company to operate an air service in German territory, when and where the Spanish government may decide. By special agreement, these air services may be exploited by a Spanish-German company which will be formed on the basis of equal participation by both countries.

EFFORTS TO obtain subsidies from the government for purchases of private airplanes are being made by the Spanish Aeronautical Federation. It is proposed that the Directorate General of Aeronautics give to private purchasers fifty percent of the purchase price of Spanish-built planes, and twenty percent of the purchase price of foreign-built planes. It is argued that in this way a more extensive training of pilots would be brought about and that increased activity consequent to the subsidy would greatly augment national interest in aviation.

MARINE AIR TERMINALS

(*Continued from page* 29)

shore where more suitable and inexpensive property might be available.

A beaching gear which has proven satisfactory in handling seaplanes up to the 6- and 8-place types where a wooden ramp is found reasonably adjacent to the hangars is shown in figure 4. This gear, which has been used for a number of months at the North Beach Airport, consists essentially of a three-wheeled dolly with a spur sticking out at either side, designed to fit the axle holes in the floats and capable of being moved in and out and raised up and down by hand cranks.

In using this gear, the ship is taxied in under power and driven up entirely out of water on the keels of its floats. The dolly is then rolled down between the floats by means of a tractor. The spurs are centered in front of the axle holes and expanded until driven home, after which the ship is lifted, and suspended by the axle holes with the keels several inches off the ground. At this point a quick adjustable rod is attached to the propeller hub so as to balance the ship longitudinally, the tractor hauls the plane into the hangar, and it is gently lowered on its keels, and the gear removed. In returning to the water the dolly deposits the ship on its keels on the lower part of the ramp from which point the pilot slides it in, under power.

The gear works satisfactorily with small machines and has the advantage of always being ready for use as it does not have to remain under the ship when the seaplane is placed in the hangar. It is not suitable, however, for use except on hard surfaced areas since the diameter of the wheels must necessarily be small. Furthermore, it cannot be used in connection with a concrete ramp since in this case it would be impossible to slide the ships up on the keels of their floats. Gear of this type can be built for about $400.

Where the hangars are a long distance from the ramp and the intervening surface is relatively rough, the so-called Boston type platform dolly is an ideal arrangement, and this gear is also advantageous where the ramp is of concrete instead of wood. Figure 5 illustrates a ship as it is being launched on this type of gear at the Boston Airport. As will be seen in the illustration the equipment consists of a flat wooden platform supported on steel beams to which automobile truck wheels are attached. The front wheels are steerable from a small bucket seat on the side of the platform from which point the driver can also control the brakes.

In receiving the plane from the water, the platform is lowered down the ramp by a rope attached to a gas truck or tractor until it is approximately two-thirds submerged. The ship then taxies in and goes aground, the engine is held partially on, and the platform is drawn to the top of the ramp in much the same way as a marine railway is operated. From this point, however, the tractor is customarily cut loose and the ship taxies into the hangar under its own power, an operator meanwhile steering the dolly and handling the brakes. Platform dollies of this type cost between $200 and $300 when constructed of second hand material and have proven very satisfactory. There are five such dollies at the Boston Airport and several of them have been in use there for a number of years.

Many combinations can be made of the basic principles covered in the various handling methods described here, in order to best adapt them to varying conditions. An interesting illustration is found at the Marine Air Transport base in Upper Manhattan. In this case an old car ferry was converted into a floating hangar by cutting out a side and supporting the roof on a cable truss. This floating base eliminates the necessity for property purchase and makes it inexpensive to shift from one location to another if desired. It also provides a constant waterline so that the hangar floor is never but a few feet above water.

As a result of the short distance through which the ships have to be moved, the need for a marine railway is eliminated and seaplanes are hauled backwards, up a short wooden ramp on their float-keels by a hand winch and placed directly on the wooden floor. They are returned to the water under their own power. Bouyancy tanks on the lower end of the ramp and rollers at the hangar end make it possible to shift it sideways in front of any ship. This permits building a narrow ramp and makes it unnecessary to cantilever it out from the side of the barge, resulting in a great reduction in the cost of construction.

AIRPORT TRAFFIC CONTROL

(*Continued from page* 44)

desirable that in spite of the power and stability required, the transmitter should not only be low-priced initially, but should also, and particularly, have a low operating cost.

On an airport where radio traffic control is desirable it is almost universal practice to use a speech amplifier system for announcing arrivals and departures of aircraft. It is desirable that the transmitter circuits and mechanical design of the transmitter equipment be such that the microphone and voltage amplifier-modulator unit may be employed as the speech amplifier system. This permits great economies by requiring only the addition of loudspeakers to provide this dual service.

Modern radio design dictates that the chassis assembly of the transmitter equipment be so constructed as to have a minimum obsolescence factor. This is possible and most practical if the transmitter equipment is so constructed that the voltage amplifier-modulator portion is built into one completely self-contained chassis and the radio-frequency portion is built into a second completely self-contained chassis, these two chassis being assembled into a simple frame. This permits sturdy, reliable, efficient construction and provides quick and inexpensive maintenance. It likewise provides for replacement of either chassis without obsolescence of the other in the event of very radical changes of audio or radio design characteristics.

Because it is anticipated that sometime in the future greater power may be permitted by Federal regulation (possibly only for radio range operation) or a multiplicity of frequencies may be allocated for this service as required by expansion of its use, it is desirable that the transmitter be so constructed that by the addition of a simple linear amplifier unit the transmitter output may be increased without obsolescence of any first purchase. Further, because of the desirability of runway or field localization units, it is best that the transmitter be so constructed that a radiobeacon accessory unit may be made part of the transmitter at any later date without obsolescence of the first purchase.

Above all, the transmitter equipment must be so constructed of sturdy components operating considerably under normal ratings to insure that the transmitter will continue to operate without failure under the extreme conditions of temperature and humidity which are sometimes encountered in airport operation. In winter operation in northern climates it is not at all uncommon for the temperature of the control operating room to drop from 70° to the temperature of outdoors because, in landing an aircraft under certain conditions, the control operator will open every window of the control tower. Humidity conditions are also very much involved in such an instance.

Receiver development and production have progressed to a stage where little need be said other than to point out that it is imperative that they be stable in operation so that they may be tuned to certain desired frequencies and will stay on those frequencies indefinitely without readjustment of any tuning mechanism. It should only be necessary for the control officer to adjust the volume of signal to arrive at desired operation. It is also necessary that such receiver apparatus be of loudspeaker-operation type and operate from 110 volts alternating-current power supply.

DESIGN OF AIRPORTS

(*Continued from page 32*)

High stage runways follow road practice and are of two general types—cement concrete, and bituminous concrete or macadam. Highway and runway operating experience, however, is quite different. Heavy motor traffic is an enemy to the rigid concrete surface, but this same traffic operates to keep alive and in good condition the bituminous pavement. Where the sub-base is firm and the water table controllable, cement concrete provides an ideal material for runways. It is highly visible from the air and its rigid characteristics assure permanently-set gradients and smoothness. The light traffic of the runway does not induce fatigue and deterioration as is the case with highway traffic. The life of a concrete runway is yet to be established.

Bituminous surfaces divide into two main classifications—the pre-mixed type, and the penetration type. With the former, there is a cushion of bituminous material between each separate piece of stone or other aggregate. The pounding of highway traffic keeps this mass kneaded and alive, but with a runway where traffic is negligible, the bituminous material shrinks, and cracks appear in the pavement. Numerous examples of this process may be seen around monuments and in safety islands where traffic does not reach. The same thing occurs with a runway.

The penetration type pavement is another matter. In that case the aggregate is rolled in place so that the particles are locked together and the binder then applied. Inasmuch as each stone is keyed to its neighbors there can be no contraction and cracks. Penetration type road specifications are suitable for runways with the exception of the finish. A typical road specification calls for a surface treatment of ½ in. stone which is bound to work loose but which is pounded back in place or brushed off to the side of the road by automobile traffic. This is not the case with runway traffic and a less harsh surface is preferable which can be obtained by the use of a surface treatment of sand instead of the ½ in. stone.

FLYING TRAPEZE

(*Continued from page 21*)

wish to correct that impression, and also to clarify the situation for Colonel Johnson, whom I ask to check my findings and to consider my conclusions.

Mr. Dennis Mulligan, an attorney, also a graduate of the Army flying school and a Reserve officer, is in Colonel Cone's Division, as Colonel Johnson correctly informed me. He had been detailed previously to several crash boards, as he is and has been Head of Enforcement Section of the Air Regulation Division. When the TWA crash investigation came along, Colonel Cone sent Major R. W. Schroeder and Mr. Mulligan to the scene to make an investigation. In all former investigations Major Schroeder, who is Colonel Cone's Assistant, had been in charge, and Mr. Mulligan, a gentleman of many years' less aviation experience than Major Schroeder, had been Schroeder's assistant and legal adviser.

When this TWA investigation was about to be opened by Major Schroeder, as senior official present, Mr. Mulligan presented a letter signed by Mr. Vidal stating that Mr. Mulligan, suddenly appointed "Assistant to the Director," would be in charge of the investigation. Neither Major Schroeder nor Colonel Cone had heard a word of this change before that moment. Mr. Mulligan, still in Colonel Cone's Division, it is true, had now, without any notice whatever to Colonel Cone, been removed from Cone's control; Cone's orders to Schroeder to take charge of the investigation were thus automatically countermanded by this sudden authority granted to Mulligan. No wonder that neither Colonel Johnson nor I had the facts clearly!

What sort of Directorial Genius is this, I ask, that leaves an official in the Air Regulation Division yet allows the Director of that Division no control over his subordinate? It seems fairly clear that if Mr. Mulligan is Assistant to the Director (Vidal) that he must be above Schroeder, who is only assistant to the Assistant Director of a Division. He also must be above Cone, in whose Division he is listed, for he countermanded Cone's orders to Schroeder to take charge of the investigation. Furthermore, even Mr. Mulligan, lawyer though he is, must be in a quandary when Colonel Cone, Assistant Director of Air Regulation Division, orders him to act as assistant to Major Schroeder, while Mr. Vidal, Director of Air Commerce, also orders him, as "Assistant to the Director of Air Commerce," to pay no attention to the orders of the Assistant Director in charge of— But this is too much for me. I leave it to Colonel Johnson to solve this puzzle propounded by Eugene L. Vidal, Director of Air Commerce, Executive Extraordinary.

ENGINES FOR AIRCRAFT

(*Continued from page 23*)

unit on an order for 10,000. This leaves $100,000 to be distributed as nominal rewards to all who compete, as well as other incidental expenses such as testing and further development by the Bureau of Air Commerce.

Space does not permit a detailed discussion of this proposal, but it might be well to point to some of its logical consequences. The idea merely contains the proposal that the Government underwrite a program of engine development. It insures the manufacturer against loss, that is, as far as his ability to dispose of these engines within a given period of time is concerned.

Now, if there is a market for 10,000 low-priced airplanes as the Bureau of Air Commerce would have us believe, the development of this engine would require an expenditure of only $100,000 of Government funds, which hardly can be compared with what is now being spent on projects which many believe will terminate in just so much experimentation.

Returning to this question of weight, how many have considered the fact that automobiles actually are sold at so much per pound? Divide the list price of several automobiles by their weights and you will find only a slight variation in the results, at the most just a few cents a pound. In other words, while maintaining comparable standards of design in mass production, material costs control the price of the product. Automobile engineers may acknowledge this fact, but as a group they have accomplished little in the matter of weight reduction which in turn should reduce manufacturing costs.

The rear-engine automobile (which should be with us before long) seems to be the first radically new improvement in many years that offers a real opportunity to show results of this nature. Therefore, why not develop an engine which is basically suitable for rear-end mounting as well as for aircraft. It is understood, of course, that the present engines are not well-suited for installation at the rear because of their form and weight. By approaching the problem in the manner suggested above, the tooling cost of the aircraft engine may be absorbed by another market which is already large enough to stand it. The engine need weigh little more than any existing aircraft engine of equal power output, and the cost of the automobile may come down as much as $100 as a result of the weight saving alone.

Obviously, it is a step in the wrong direction to design and build airplanes around engines whose specific weights are comparable to those of the 1910 vintage. If this were the only means through which low-cost engines could be secured for the promotion of this part of the aircraft industry, we might—by a severe strain on our imagination—agree to revert to the old days of heavy engines with their uncertain reliability. However, we recognize that weight in itself means higher cost for the same design standards and quantities produced. Thus, in reality, we move backwards in converting these engines for aircraft use, and furthermore we place a stamp of approval upon the automobile industry for its short sighted policies. If we must depend upon automobile production to effect lower manufacturing costs, it would be far better to wait a while longer for that light rear-mounted engine, which eventually must be built to aircraft standards of weight and reliability.

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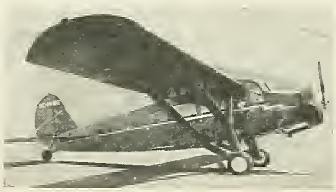

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CURTISS JR.: Relentlessly majored and licensed to July. Many extras. Total time 300 hours. Always hangared. $500. Details, write McClellan & Darrach, 1292 Hertel Ave., Buffalo, New York.

J-4 EAGLEROCK: Ship in perfect shape, also motor in good shape. Steel propeller, two new Scintilla mags. Will sacrifice, $600. Paul R. Thompson, 1928 Norton Ave., Independence, Missouri.

CABIN WACO: 4-place, with 165 Continental. 300 hours; private only. A perfect and beautiful job. Reduced to $1,685 for quick sale. Licensed to October 1936. Terms to responsible party. Write, wire, A. C. Lohman, 325 San Gabriel Drive, Rochester, New York.

FOR SALE: Taylor "Cub". Manufactured 1933. Always hangared, perfect condition. Continental A-40-2 engine, less than 250 hours. Price $800. Dennis Powelson, Starke, Florida.

STATES SUPER MONOPLANE: Rover powered, four-cylinder inverted. Two-place open monoplane. Just major overhauled. Licensed to August 1936. Weyman Alger, 943 Broadway, Gary, Indiana.

BUHL PUP: Licensed July 1936; snappiest looking Pup in the east. Everything A-1. Price $420. Can be seen Flushing Airport, New York, care of Ray Brown.

OX-5 ROBIN: $300; Bird, $425; Heath, $65. Three of hundreds of bargains listed in Used Aircraft Directory. Sent for 20c postpaid. Used Aircraft Directory, Athens, Ohio.

ENGINES: Majored by approved agency. Hornet B, $1,500; Hornet A-1, $850; Wasp S-1-D-1, $2,500; Wasp C, $1,100; Wasp B, $750; J6-9-D, $1,100; J6-7-D, $775; J-5, $500. Kinner K-5, $300. Lycoming 215 h.p., $595. Babh, 1100 Airway, Glendale, California.

WACO BSO: Wright J6-5, total 300 hours, modernized and fully equipped; 8.50-10 tires; beautiful finish. Great Lakes Trainer: American Cirrus, 600 hours, many extras. Stinson S, Kinner Bird, Waco Ten. Write for prices. J-5 propeller, good, $60. Autofan wheels, 8.50-10, like new, $25. Magnetos, carburetors, engine parts at bargain prices. Pontiac Aircraft Company, Pontiac, Michigan.

LICENSED TRAVEL AIR 2000: Good condition, air wheels, fenders, covering good, newly upholstered cockpits. New propeller, motor like new, Miller overhead. Price, $600. Frank Mascol, 5011 Lorain Avenue, Cleveland, Ohio.

WACO TEN: Late model; licensed. Recently refinished, covering excellent condition. Motor Millerized OX-5. Only 52 since new. $550. Harold Ownhy, Y.M.C.A., Waterloo, Iowa.

FLEET, KINNER K-5: Porterfield, OX-5 Waco, Taylor Cub, Taylor Chummy (less engine). Kinner K-5 engine, Cirrus engine parts. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

ALL MAKES: Cabin planes. Warner, J6-5 Stinson, $775—$900. J-5, Lycoming, $1,000—$1,200. Waco C, $1.675; 1934 Jacobs, $4,000. Terms arranged. "Pioneer," care Airport, Syracuse, New York.

FOR SALE: 4 complete brand new 150 h.p. 7-cylinder Axelson B aircraft engines, $150 each. 3 used engines, $100 each. Air-Parts, Inc., Glendale, Calif.

OX ROBIN: Millerized motor, turns 1410 on blocks. Licensed to June 15, 1936. New tires; good condition throughout. $475 cash. Roland W. Fleischauer, LeSueur, Minnesota.

STINSON J6-5: 175 h.p.; 4-place. Licensed to July 1936. Battery, landing and navigation lights, booster; $925. Licensed J6-9 Travel Air 6000, $2,000. Iowa Airways, Fort Dodge, Iowa.

JOHNNY MILLER'S LOOPING AUTOGIRO for sale. Pitcairn 3-place, 330 Wright E, special equipment, 700 hours, excellent condition. Write John M. Miller, South Egremont, Massachusetts.

WILL TRADE OR SELL cheap: J-5 trimotor Ford fuselage, damaged; wings, motor and propellers good. Write Joe Musleh, 15 Beverly Road, Asheville, North Carolina.

VELIE MONOCOUPE: Licensed until July 1, 1936. Excellent condition; motor, propeller and fabric. $.25. Consider trade on open ship. Edgar F. Smith, II, 3312 Olive, Kansas City, Missouri.

WACO TEN, OX-5: Licensed May '36, $350. 180 h.p. Hisso Command-Aire, unlicensed, $300. Siemens Command-Aire, licensed May '36, 130 hours total, $650. Stover Midwing Special, 1POLC, 45 h.p. Szekely, $300. John W. Stover, Municipal Airport, Hot Springs, Arkansas.

● PLANES and ENGINES FOR SALE

STEARMAN: Wright J6-7, modernized; recently refinished and motor majored; wheel pants, speed ring, cockpit cover, flares, dual instruments, radio, bank and turn, rate of climb, etc. Priced for quick sale, $1,300. AERO DIGEST, Box 2148.

FOR SALE: Speedwing Travel Air B-4000. Licensed, J-5, Hamilton steel propeller, 50 since complete overhaul; has compass and clock plus regular instruments and air-speed; dual controls, oleo-air shock absorbers, radio shielded throughout; night flying equipped, less landing lights; brakes and tail wheel; top speed, 125, 64 gallon gasoline capacity. Previously owned by the Department of Commerce. First cash offer $1,100 takes airplane. Write Graydon Withey, 206 Dryden Building, Flint, Michigan; phone Flint 2-4325.

3 FOKKER TRIMOTORS: Equipped 3 Wasp 420 h.p. engines. Ships fully equipped and licensed, each $2,100. Lockheed Orion: $5,500. Fairchild 42: $1,950 Northrop Gamma: Cyclone engine. $20,000. Many other ships. Babb, 1100 Airway, Glendale, California.

DRIGGS SKYLARK: 75 h.p. Rover. New sport model. A beauty. Only 28 hours. 6.50 x 10 tires and brakes; air speed, compass, etc. $1,450. A. E. Hultzen, 843 N. Pine, Chicago, Illinois.

AEROMARINE KLEMM: 30 h.p. Salmson powered low wing monoplane. Looks and flies like new. Safe; economical. $600. $300 down, balance monthly. Finance Co., Hemlock, New York.

BUHL BULL PUP: Szekely. Excellent condition. Motor majored 25 hours ago. Motor 180 hours, ship 175 hours. Bargain at $400. Flyaway. Chin Non, Lewistown, Montana.

WACO TEN: For immediate sale. Entirely recovered and hand finished this summer. Licensed. Motor in excellent condition. It will pay to investigate this bargain. Harold Preston, Municipal Airport, Fort Wayne, Indiana.

TRIMOTOR TRIAD: 4PCLM; 3 LeBlond 65's. Total time 250 hours. Price, $1,475 or trade for Aeronca or similar licensed ship. C. M. Mood, 519 Milson St., Emporia, Kansas.

WACO F WARNER: Extras, good condition, $1,600. Lincoln Trainer, good condition; radio, bank and turn, air speed, rate of climb, clock and many others. A real blind flying insturction job, $1 100. Both real bargains. See these before buying. The H. C. Robbins Co., Cleveland Airport, Cleveland, O.

VERVILLE SPORT: 165 Continental. Just completely overhauled and ship relicensed. Steel prop. brakes, tail wheel, front cockpit cover, air mail windshields. Instruments in both cockpits. Cruises 97. Ideal for the sportsman pilot or advanced training. Meinke-Eldred Flying Service, Willoughby, O.

FOR SALE: Fairchild 22, like new; only 20 hours on Wright Gipsy motor. Aeronca C-3, 2-place; motor just rebuilt by Aeronca factory; new tires, extra instruments. Both ships guaranteed equal to new. S. Fraser, 2056 Ryder St., Brooklyn, N. Y. or Hangar 3, Floyd Bennett Field.

SEAPLANE: Straightwing Waco, J-5; 50 hours since major; licensed September '36; first-class condition throughout. Duals, extra gas tanks, navigation lights, direct starter. On Edo floats, guaranteed for one year. Also, wheels and landing gear. Hangared North Beach after Sept. 25th. Will demonstrate within 300 miles. AERO DIGEST, Box 2141.

PARKS P-1: 3POLB; licensed. In good condition. OX motor time, less than 40 hours. Ship time, 340. New prop. Priced for quick sale, $350. Gerald D. Griffin, Westboro, Massachusetts.

FOR SALE: J-5 Fairchild cabin. Five passenger. Good condition. Licensed. $800. Fur-lined leather flying suit and moccasins. Practically new, $75. Aeromarine motor, slightly damaged, $450. Located Chapel Hill, N. C. Apply Mrs. I. Montrose Tull, Jr., Vero Beach, Florida.

TRAVEL AIR 6000-B: J-6 300, completely equipped: fine shape, $1,650 cash. Will consider trade; any small ship, land or sea. AERO DIGEST, Box 2143.

STINSON S: Completely reconditioned and Lycoming engine major overhauled, with new heavy duty crankshaft installed. Ship completely refinished and in beautiful shape. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

BEST BUYS ON PAGE: Less motors. J-6 330 h.p. 6-place Stinson, excellent condition, less motor; B-1 5-place Ryan cabin ship, Goodyear full Airwheels and brakes, air tail wheels, dual controls, $675 for quick sale, less J-5 motor. Michigan Aero Motors, Jackson, Michigan.

LE BLOND ENGINE: 65 h.p., A-1 condition. Complete and ready for installation, $125. George Meyers, "H" and Luzerne Sts., Philadelphia, Pa.

WARNER CESSNA: $795. Wing recovered, licensed July. Warner Stinson: $675; licensed. Late crankshaft both Warners. Will sell any engine, propeller, ship less engine. Parts: Eaglerock, Travel Air. Merle Buck, Onalaska, Wisconsin.

LATE CURTISS JR.: $400. Recovered, majored and relicensed. Ready for service. Only 196 hours. Velie Monocoupe wanted. Bud Fleck, 1134 E. Pine, Springfield, Illinois.

AVRO AVIAN biplane: Folding wings, wing-slots, dual controls; instruments in both cockpits; licensed for one year. Blue and silver. Ready fly away. Joseph Jacus, Box 159, Manville, N. J.

LYCOMING STINSON: $1,450 cash. Sixty hours since complete recover and overhaul. Red and yellow. Best buy in Middle West. Alton Walker, Graphic Arts Bldg., Kansas City, Missouri.

FAIRCHILD 22 with Inverted Cirrus engine; excellent condition, $1,185. J. T. Moore, Jr., Reading, Pennsylvania.

STINSON "R": Perfect throughout; motor just now majored. Night equipment; leather upholstery, $2.750; will take smaller ship in trade. S. Krantz, 4180 "L" Street, Omaha, Nebraska.

FLEET: Late type Warner, just overhauled, recovered. High gloss finish. Cockpits, seats, leather lined. Double instruments. Wright J6-7 Travel Air, open, perfect condition, just relicensed. Howard Schmidt, 20-16 Whitestone Ave., Whitestone, L. I., New York.

GREAT LAKES 2T-1A: Fast stunt job, well faired; inverted flight equipment, night flying equipment; front cockpit cover, airwheels. Only 375 hours, 90 since major overhaul. $1,000. Davis: LeBlond 65, speed ring, cockpit cover, special head rest. Licensed September 1936. $750. Will consider trade both ships for larger plane. Cedric Galloway, Austin, Minnesota.

LAMBERT MONOCOUPE: New December 1931, recovered last year. Motor has 100 hours since factory rebuilt. Turn and bank, rate of climb; licensed until April 1936. Speed ring, steel prop, excellent condition, $1,650. Brayton Flying Service, Inc., Robertson, Missouri.

PORTERFIELD: 70 LeBlond. Just repossessed. 45 hours; like new. Location Georgia. May be bought for $300 down and balance monthly, financed by us. Act quickly on this one. Finance Co., Hemlock, New York.

KINNER SWALLOW TP: Licensed July 1936; late type motor; 65 hours time since new; ship excellent shape; new Flottorp prop. Sacrifice, $775. C. A. Coons, 249 Academy Street, Jersey City, New Jersey.

TRAVEL AIR: J6-7. 4-place cabin monoplane, $1,250. Will consider trading against smaller ship: Bird, Fleet, Waco preferred. Everett Moniz, 101-29 114th Street, Richmond Hill, New York.

CHALLENGER ROBIN: Just relicensed; 25 hours since major. Special upholstering, covering excellent, starter, steel propeller, heater. $1,100. Monty Barnes, Municipal Airport, Wichita, Kan.

DAMAGED GENET BARLING NB-3: Will sell as is for $325 or repaired and relicensed including recovering for $550. LeBlond 65 motor, complete, as is, $95. Arthur Smith, 1453 Barnesville Street, Pittsburgh, Pennsylvania.

J-5 TRAVEL AIR: Licensed. Forced sale, $895 cash. Beautiful performer. Motor perfect, 60 hours since major, 360 total. Plane red, black, gold. Rare bargain. Justin R. Neff, 101 King St., Burlington, Vermont.

CURTISS JUNIOR: Only $295 flyaway Syracuse; dual controls: licensed until August 1936. Waco, $425; Monocoupe (Velie), $550. Terms arranged Pioneer Aviation, care Airport, Syracuse, N. Y.

WACO F: K-5, $1,375. Licensed until July 1, 1936. Ship and motor recently overhauled and refinished. Ralph Brichta, 2531 N. 37th St., Milwalkee, Wisconsin.

FOR SALE OR TRADE: Taylor Cub, less than 6 months old, private owner. Equipped with lights, enclosure, compass. Want 2- or 3-place Warner-powered ship. A. R. Greene, 2532 South 22nd Street, Philadelphia, Pennsylvania.

FAIRCHILD KR-21: Sport biplane, 2-place. 100 h.p. Kinner; brakes, metal prop, balloon tires. 275 total hours, all private. Advertised last month at $1,175. Must sell at once; will take $975 now. Wire, write, A. C. Lohman, 325 San Gabriel Drive, Rochester, New York.

DE LUXE STINSON R: Lycoming, licensed, excellent condition, extras, $2,500 cash. Air-cooled trades considered. Set Ryan retractable landing lights, $35; Pioneer bank and turn, just factory overhauled, looks new, $35; Travel Air 2000 tail surfaces, make offer. Valley Airways, Inc., Winchester, Virginia.

FOR SALE OR TRADE: Curtiss Seagull flying boat with C-6 motor; licensed; ready to fly away. C. N. Zeidler, Mill Basin, New York. Waldron and Markey Seabase.

FAIRCHILD 24: Cirrus; never cracked up; dual control; motor new, less 15 hours. Steel propeller. Total ship time 365 hours. C. Descomb, Crystal Drive, Wethersfield, Connecticut.

AERONCA C-3: Motor being majored now; complete with reconditioned Edo floats and landing gear; licensed to September 1936. $1,200 cash. AERO DIGEST, Box 2149.

WARNER STINSON: Just relicensed. Accept best cash offer over $650; or, will trade Stinson with some cash for small job. Near Philadelphia. AERO DIGEST, Box 2145.

CURTISS JR.: A-1 condition. 200 hours on ship. Price, $375. Accept car in trade. Michael Gunther, Box 48, Hudson, Massachusetts.

VELIE MONOCOUPE: 32 feet wing, split type landing gear; refinished, 20 hours since engine major, licensed August 1936; $575. Raymond Douglas, Devils Lake, North Dakota.

FOR SALE OR TRADE: J-5 Buhl Air Sedan. Good fabric, excellent motor; complete night and blind flying equipment. Lycoming Stinson SM8A: Excellent fabric; retractable landing lights; fuselage just refinished. Arthur Currey, Airport, Monmouth, Illinois.

AERONCA C-3: No time since factory major (E-113-A motor). Winter enclosure, airwheels, oleos. Must sell: cash or terms; $375 down. Wire "Al" Leeward, New Kensington, Pennsylvania.

AERONCA CABIN: 1935 model. Position lights; motor and ship like new. For quick sale, $1,375. Box 103, Orange City, Florida.

STEARMAN 4-E: Wasp; Boeing 95, Hornet; Cessna, J6-7; Travel Air 4-place, J6-7; Waco F, Warner; Kinner Bird; Avro-Avian. Pontoons complete for FC Fairchild; Hornet motors. Chuck O'Connor, Barnes Airport, Westfield, Mass.

FOR SALE OR TRADE: Waco cabin, completely rebuilt, less engine. Also Waco 9, licensed, $390. Schupack, 102 Henry St., Hasbrouck Heights, New Jersey.

OFFERS FOR IMMEDIATE SALE at closing out bargain prices: J6-5 175 h.p. Wright motor, $325. J-4 220 h.p. motor, $195. J6-7 250 h.p. Wright motor, $575. Velie 65 h.p. motor, $115. J6-9 330 h.p. motor, as is, $350. Nearly new J6-9 330 h.p. Wright motor, just major overhauled, $850. Brand new 22 x 10 x 4 Goodyear full Airwheels, including new hubs, $35 each. Steel propellers for above motors priced on request. All Warner and Wright motor parts, 60% to 80% off. B-1 5-place Ryan cabin ship, less J-5 motor, $675. We are closing out. Write or wire your needs. Michigan Aero Motors, Jackson, Michigan.

AMERICAN EAGLE 4-place cabin. Continental 165 h.p. Best of condition, majored. $1,400 or trade for Fleet or Waco F. Wanted: Warner and J-5 engine, any condition. Dycer Airport, 9401 So. Western, Los Angeles, California.

BIRD: Like new. Kinner motor with only 30 hours since major, $1 300. Waco F, $1,450; J6-5, $1,000; J-5 Waco with floats, $1.600. "Pioneer," care Airport, Syracuse, New York.

FOR SALE: Jacobs cabin Waco; Eaglet; Straightwing Waco; Kinner Travel Air Sport; Stinson S; Stinson Reliant; Great Lakes; Bellanca Skyrocket; Bellanca Pacemaker; Kinner Fleet; Fairchild 24; Fairchild Warner 22; J6-7 Stearman; Wasp Laird; cracked-up Laird; Monocoupe and Fairchild parts; Wasp C motor. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, N. Y.

STINSON SR5A: With flaps, Smith propeller, radio, night and blind flying equipment. Delivered November 1934. Perfect condition. Motor just majored. John Shobe, Boston Airport, East Boston, Massachusetts.

FOR SALE: C-3 Spartan biplane, excellent condition; with damaged Walters motor, or trade plus cash on 3-place ship; or will purchase used or damaged Walters motor. Inquire Mollison Airport, Stratford, Connecticut.

AMPHIBION, PRIVATEER: Two-place monoplane; duals; licensed May 15, 1936; 125 Warner, 325 hours; always privately owned. $1,000 cash or exchange for Savoia 3-place. Harry Freedman, 205 West 39th Street, New York, N. Y.

LC-B LAIRD: With J-5, little time; newly recovered, very nice condition and a fine performer, $1,500. Pitcairn Autogiro with B-5 Kinner, complete new rotors, completely recovered. J-5 magnetos, cheap. Waco ten parts. Hugelen Flying Service, Leland, Iowa.

WACO 4-PLACE CABIN: New July 1933. Just relicensed, blind flying instruments, clock, drift indicator, radio, landing lights, flares, generator; Continental 210, just overhauled; total 402 hours; entire ship in perfect condition. A steal at $3,250. Fenton, Transcontinental Airport, Toledo, Ohio.

FAIRCHILD FC-2: Completely overhauled, recovered, repainted; J-5-A, major overhauled; total hours on engine, less than 100. Ship and engine for $1,000. Hartling Neal, Conway Airport, Conway, Pennsylvania.

CHALLENGER OX-5: (Fairchild KR-34); duals, $350. Doyle O-2, powered with LeBlond 65, $425. Both ships majored, ready flyaway. R. V. MacNemar, Baltimore Airport, Windsor Mill Road, Woodlawn, Md. Phone: Woodlawn 339; Madison 5399 W.

PORTERFIELD FLYABOUT: 100 hours total time, LeBlond 70, special paint job, speed ring, compass, perfect condition; price, $1,350. AERO DIGEST, Box 2146.

FOR SALE: Waco 10 with recovered fuselage, 850-10 air wheels, good condition, $400. Stinson Trimotor Model T, has three recently overhauled Lycoming engines, 35x15-6 Goodyear Airwheels, all propellers recently etched, equipped with latest type hydraulic brakes, general condition good; licensed till July 1936, $2,000. Two J-5 engines with less than 75 hours since major overhauls, each, $350. One Heywood starter with all fittings, $50. One Bijur electric starter for J-5, $35. One speed ring for J-5 engine, $25. One Lycoming R-680 engine, $350. Waco 10 upper wings, tail group, and other parts at give-away prices. One overhauled OX-5 engine with new water pump and carburetor; best offer takes it. One set of 6" airwheel hubs for Stinson trimotor; any offer considered. Want good used parachutes and will trade on Stinson Reliant. Mackey Flying Service, Findlay Airport, Findlay, Ohio.

WALLACE TOUROPLANE: Kinner-powered; three-place cabin; folding wings; side-by-side duals; brakes; total time on motor, 35 hours; total time on ship, 231 hours; guaranteed first-class condition; $975. Stewart Motor Trucks, Inc., 933 Franklin Avenue, Brooklyn, New York.

STINSON JR. SM8: Wright J6-7, 250 h.p., $1700. Waco Straightwing, late model J-5, tripod type landing gear; motor just majored, fabric excellent, $1,200. Bird, Kinner K-5, excellent, $1,100. Waco F, Kinner B-5, Heywood, excellent, $1,300. Ford Trimotor, late type, three J-5's, electric starters; total time on plane, 590 hours; will take J-6 300 engines; ship and engines A-1 condition, $5,000. Major L. G. Mulzer, Norton Field, Columbus, Ohio.

AERONCA: Master C-3; 150 hours, $1,500. Fairchild 71, Wasp, Airwheels, $2,000. Waco 165, $1,400. Travel Air, 125 Kinner and chute, $2,000. All excellent condition. Red Bank Airport, Red Bank, New Jersey.

J-5 AMPHIBIONS, INC. 5-place flying boat, or four-place Amphibion. NC licensed to November 1936. Have spare engine; propeller; overhauled set of wings, and other parts. $1,250 takes everything. R. Kenyon, 345 Linwood Ave., Newtonville, Mass.

TANK-POWERED WACO: Fuselage and tail group just recovered, ship equipped with steel propeller, airwheels with brakes. Any reasonable offer given consideration. Milton Hershberger, Put in Bay, Ohio.

FOR SALE: Long-nosed American Eagle, OX-5 motor. Licensed, duals; less than 100 hours since factory overhaul, $375. Roy Rasmussen, Devils Lake, North Dakota.

SKYLARK FACTORY SPECIALS: I Gipsy de luxe Demonstrator; 1 Rover factory rebuilt. Both excellent shape. Bargain prices; trades accepted. Write: Skylark Aircraft, Muskegon Heights, Mich.

SZEKELY 45: In excellent condition, complete with instruments, $145. Many used Szekely parts at 60% less list price. Pair 7x3 wheels, one tire and tube, $15. Bud Greenert, 18 Roosevelt Apt., Butler, Pennsylvania.

MONOPREP, VELIE M-5 engine: Airwheels, airspeed, compass, licensed, $475 cash. Heath Parasol, Sensenich converted Henderson engine, 10 hours total time, $150 flyaway. Myers Aviation Co., Brackenridge, Pennsylvania.

NEW TAYLOR CUB: Also late Waco Cabin, equipped blind and night flying, extras. Sacrifice. Used aircraft battery, $5. Paul Peterson, 2503 Union Ave., Altoona, Pennsylvania.

DE LUXE UIC WACO: Radio, 10 hours on motor, $3,500. New Cyclone engine, R-1750-CE, in crate, $700. Kingbird J-6 300, low hours, complete instruments, Sperry, radio, $7,500. Velie Monocoupe, $500. DH Gipsy, Challenger, J-5 and Velie engine parts, some new; DH magneto. T. W. Robertson, Hadley Aircraft, Inc., Hadley Airport, New Brunswick, New Jersey. See our ad in Buyers' Directory, this issue.

CLIPPED WING Warner Monocoupe: Fabric and wing one year old. Motor 625 hours. Here is a real ship for aerobatics. This ship flies better than a standard wing job. Priced to sell; will trade. Marcelius King, Sherburn, Minnesota.

BARGAINS: Travel Air E-4000, with Wright J6-5 engine. Ship just completely overhauled and recovered by Approved Repair Station. Many extras, including 29 x 13-5 Goodyear Airwheels, brakes, electric starter and complete winter enclosure over both cockpits. A real buy at $1,380. Eaglerock A-1 with J-5 engine; ship just overhauled and in best possible condition. Only $975. Aircraft Mechanics, Inc., Colorado Springs, Colorado.

AERONCA C-3: Built 1932. Was recovered last February. Engine has new type heavy duty crankshaft and needle roller bearings. A real buy. $925. Will finance or take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

EAGLEROCK OX-5: Licensed to October 1936. Total time only 346 hours. Steel propeller. $400; will sell on time payments to responsible party. AERO DIGEST, Box 2152.

TAYLOR CUB: Like new. Built June 1934. Total time 130 hours. Licensed, privately owned; powered with Continental A-40-2. Equipped with winter enclosure. Price $950. AERO DIGEST, Box 2153.

1934 DE LUXE WACO CABIN: YKC model; Jacobs engine; total time 212 hours; complete instruments, including radio, flares, thermocouple; 70-gallon tanks; hand-rubbed finish: wings, deep yellow, fuselage, black. Equipped with built-in fire extinguisher installation; wheel pants; appearance and condition of ship perfect. B. F. Brazill, 1580 East Grand Boulevard, Detroit, Michigan.

1935 DE LUXE LAMBERT MONOCOUPE: 7 months old; never damaged. 115 hours; privately owned; good as new. Streamline tires and wheels, cabin heater, tail wheel, golf bag compartment; engine and pyralin covers; $2,950, cash. Trades considered. Aviation Clearing Co. of Mineola, Inc., Roosevelt Field, Mineola, New York.

KINNER BIRD: Unusually fine; front exhaust. 90 hours since complete major overhaul by authorized Kinner agency; equipped with starter, brakes, Airwheels; turn and bank, airspeed; front cockpit cover, steel propeller, etc. Fabric and upholstery, etc., perfect. $1,650. Waco C: Late 1933; 210 Continental. Total time 235 hours; 35 since top overhaul. Equipped with starter, brakes, airwheels, pants, airbrake, dual wheel, etc. Finished gray, with silver wings and like new in every respect. $3,250 for quick sale. Taper Wing Waco J-5; 25 hours since major on engine; ship completely rebuilt and covered August 1934; never cracked; has brakes, starter front cockpit cover, etc., $1,400. Waco C, 210 Continental: Built November 1933. Total time 645 hours; 100 hours since factory major overhaul and installation of salt-cooled valves. Equipped with turn and bank, radio, electric starter, landing lights, special upholstery, etc., $3,000. These ships absolutely as represented, and number of hours stated accurate. Air Service, Inc., Bellanca Field, New Castle, Delaware.

4 AIRPLANES FOR SALE: American Eagle OX-5, long nose, interchangeable with Kinner motor, $585. OX-5 Waco 10: Millerized, excellent shape, $450. OX-5 Travel Air, detachable motor mount, $585. Velie Monocoupe, new motor, $550. All licensed, excellent condition, always hangared. Sheldon Airport, Sheldon, Iowa.

1935 WACO CUSTOM CABIN: 285 Wright; Hamilton controllable; special paint; RCA radio; landing lights, complete instruments, 100 gallon tanks. Plane has only 75 hours, in perfect condition. No damage of any kind. Sacrifice for cash. AERO DIGEST, Box 2154.

D-145 WARNER MONOCOUPE: Special paint job and extras; licensed. Total time on ship and engine, 21 hours. Cost $6,000. Will sell for $2,000 cash. C. G. Hill, Box 2101, Winston-Salem, North Carolina.

GREAT LAKES 2T1A: Recently recovered. No time since complete overhaul. Both ship and engine in perfect condition. $1,150. Will finance or take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

FOR SALE: Lambert engine in excellent condition, only 8 hours since factory rebuilt. Price $475 cash, f.o.b. Bartlesville. Walter Conradt, successor Star Aircraft Company, Bartlesville, Oklahoma.

STINSON TRIMOTOR: Wings, fuselage refinished, A-1 condition. Two Travel Airs, J-6 330, radio, night flying equipment, overhauled fuselage and tail. Curtiss Fledgling: Overhauled and relicensed. Cirrus Driggs: Relicensed, new motor. Lincoln Kinner. Sell or trade any of above for fast six-place plane. Monarch Air Service, Municipal Airport, Chicago, Illinois.

FOR SALE OR TRADE: Waco F, A-1; J-5 Ryan B-1, just majored. Challenger Robin, very good. Fairchild 22, A-1, extra equipment. Axelson motor, new. Aviation Service Co., Inc., P.O. Box 32, Hartford, Connecticut.

ROBIN: Challenger motor new, total 10 hours; in excellent condition; reasonable. Or will exchange for amphibion. Edwin J. Ahrens, 2762 Hudson Boulevard, Jersey City, New Jersey.

CURTISS CHALLENGER ROBIN: 98 hours since complete major overhaul. Licensed to July 1936. Will finance or take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

CURTISS ROBIN: Challenger 185 h.p. Diana cream, trimmed with black. Speed ring, navigation lights, dual controls. Engine has 40 hours since major overhaul. Ship licensed until July 1936. $1,100. Bill Phillips, 1248 Flatbush Avenue, Brooklyn, New York.

FOR SALE: OX-5 WACO 10 GXE. Licensed to July 1, 1936. New motor, 15 hours total time. Total time on ship, 305 hours. Ship in A-1 shape. Ivan Hillard, Evansville Airport, Evansville, Indiana.

FAIRCHILD CHALLENGER KR-31: 3-place biplane. Millerized OX-5. Perfect condition. Always hangared, never cracked. Licensed until September 1936. Repainted. Will sacrifice for $425. George Seese, Wilmerding, Pennsylvania.

PORTERFIELD: Like new; total time 50 hours; will sacrifice. Lycoming engine, 100 hours since major overhaul, $400. Colin Davies, 2021 Baringer Avenue, Louisville, Kentucky.

FOR SALE OR TRADE: St. Louis Cardinal, two-place cabin, side-by-side, Kinner-powered; ship and motor in excellent condition; tops 125, lands 40. Equipped brakes, compass, air speed, duals; must be seen to be appreciated; photos on request. $800 cash or will trade for three-place open ship. Glen Niederhauser, Marshalltown, Iowa.

1933 CABIN WACO: With 1934 Continental engine; time, 100 hours. Just top overhauled. Radio, electric starter, engine-driven generator and storage battery. Price $3,500. Beechcraft Sales Co., Hangar 9, Roosevelt Field, Mineola, New York.

FOR SALE: J6-9 Bellanca Pacemaker; 500 hours, 20 hours since top overhaul; refinished berry red, black trim. Just relicensed for a year. $3,250. J6-9 Ryan, 25 hours since ship completely recovered, $1,650. C-3 Aeronca: 2-place, 600 hours; 35 hours since plane completely refinished, fuselage recovered, motor now being top overhauled. Will consider trading-in light two-, three-place job. $850. Raymond Aircraft Co., Macon, Georgia.

TRIMOTORED STINSON AIRLINER: Model T. Ten-place, equipped with radio. Is flyable but needs work for relicense. Full details on request. Will accept smaller ship as part payment. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WACO F WARNER: Dual control, brake; licensed to July 1936. Privately owned. Total time, 500 hours; motor majored. C. Descomb, Crystal Drive, Wethersfield, Connecticut.

LAMBERT DELUXE MONOCOUPE: 105 hours, less than year old; turn and bank, starter, battery, red leather upholstery, wheel pants, tail wheel; magnetos radio shielded. Grey trimmed in red. Never damaged. Always privately owned. $2,725. Central Aeronautical Corp., Municipal Airport, Indianapolis, Indiana.

DEADLINE FOR CLASSIFIED ADVERTISING, NOVEMBER ISSUE—OCTOBER 19th

Copy arriving after that date will be held over for the December issue

PLANES and ENGINES FOR SALE

AERONCA 1934: Looks like new; brakes, lights, enclosure; licensed Sept. 1936; owner buying new Aeronca. $985 cash takes it. United Aero Corp., P. O. Box 222, San Antonio, Texas.

1933 CONTINENTAL WACO "C": Landing lights, special mohair upholstery, radio. Motor has 100 hours since complete overhaul, installing salt-cooled valves and latest recommendations. Price $2,600. A. Felix duPont, Wilmington, Delaware.

AMERICAN EAGLE: NC license, excellent condition, full Airwheels; high compression Millerized OX-5; 30 hours. Duals. $395. Louis Cuburnek, 5829 Hobart St., Pittsburgh, Pennsylvania.

SIEMENS HALSKE CESSNA: Licensed, good covering, motor good. Priced to sell. Late type Velie Monocoupe, little time, air wheels; a real buy, $550. Will trade. C. W. Siebl, Sherburn, Minnesota.

STINSON R: Perfect condition; equipped for night; ring cowl, wheel pants; never cracked; $1,950 cash. George Casey, 4227 Snelling Avenue, Minneapolis, Minnesota.

PITCAIRN Sport Speedwing: J-5, latest type. All extras; total time 50 hours; must be seen to be appreciated. Will accept smaller 3-place job. Noble Mills, 41-42 42nd St., Long Island City, N. Y. STillwell 4-0998.

SAVOIA MARCHETTI AMPHIBION: Kinner 125 h.p. engine. For details, AERO DIGEST, Box 2160.

JACOBS BEECHCRAFT Demonstrator: 230 hours total time; 25 hours since top overhaul. Excellent shape; sensitive altimeter, bank and turn. Sacrifice for cash. Beechcraft Sales Co., Hangar 9, Roosevelt Field, Mineola, New York.

GIPSY FAIRCHILD 22: Out of the factory only two weeks. 19 hours total time. Brakes both cockpits, cost $3,015. Will sacrifice, $2.450. Will consider trades. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

FOR SALE: Taylor Cub, 8 months old; like new; winter enclosure, Continental motor; for quick sale, $1,075. Also Challenger KR-34-C, Wright J6-5, Airwheels, brakes in both cockpits; tail wheel; motor and ship in A-1 condition; $1,200. Jennings Bros., Danbury, Conn.

VELIE MONOCOUPE: 32-foot wing. Ship and motor in excellent shape. Licensed to May 1, 1936. Price $495, cash. Richard Riedel, 936 Lansing Ave., Austin, Minnesota.

WACO F KINNER B-5: 450 hours; black with red wings; Heywood starter, baggage compartment, navigation lights. $1,575. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

NEW AXELSON B-7 with propeller and hub. J-5 No. 9355, majored, practically new. Continental 165 h.p. V. L. Olmstead, 2407 Indiana, Kansas City, Missouri.

TRAVEL AIR OX-5: Newly recovered, color red and silver; motor overhauled, DH wheels, relicensed till September 1936. Price, $500. Walter Beeler, Huron, South Dakota.

TAYLOR CUB, Aeromarine: In excellent condition, factory conditioned, 285 hours, $975. Fairchild 22: 280 hours since factory major overhaul, $1,200. Waco Cabin: 1934, Continental motor just modernized factory; less than 300 hours on plane. $4 500. Smith Flying Service, Wyoming Valley Airport, Wilkes-Barre, Pennsylvania.

AMERICAN EAGLE 201 and Travel Air K-4000: Both with Kinner K-5 engines, licensed, A-1 condition, and priced to sell. The Lake County Airways Corp., Willoughby, Ohio.

VELIE MONOCOUPE: Just completely recovered and relicensed. Split type landing gear. $600. Will finance. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WACO BSO WRIGHT 165: 165 hours, 75 since major engine overhaul; brakes, metal propeller, landing lights, navigation lights, flares, fuel pump, inertia starter, 62 gallons gasoline, 10 gallons oil, baggage compartment, battery, booster, new type blower section, instrument lights, fuel pressure gauge, complete instruments; newly recovered with rub finish, yellow trimmed in black. Always hangared. Never cracked. Sacrifice at $1.250. Central Aeronautical Corp., Municipal Airport, Indianapolis, Indiana.

ARROW SPORT: LeBlond 65 motor; broken crankshaft, plane and motor in otherwise A-1 condition. Imperative to sell immediately. AERO DIGEST, Box 2156.

TAYLOR CUB: $750. Single-place Aeronca, $400. Two-place Aeronca, $900. Curtiss-Wright Air Sedan, $1,000. All ships licensed and in good condition. East Dayton Airport, Dayton, Ohio.

J-5 TRAVEL AIR: Just major overhauled, in fine condition, $1,150. Will take unlicensed Argo with Hess-Warrior engine or Wright Stinson SMA8 as part payment. Charles West, Teterboro Airport, Hasbrouck Heights, New Jersey.

TRAVEL AIR 6000-B: 6-place, Wright J6-9 330; licensed October 1936. Total time 800 hours; good condition; electric starter, night flying equipment. $2,000. AERO DIGEST, Box 2163.

FOR SALE: 1933 Continental Waco "C". Total time 335 hours. Only 50 hours on engine since factory overhaul. Extra equipment: Lear radio, landing lights, electric starter and generator, bank and turn, rate of climb and air brakes. Finish in good condition. Price $3,300 at du Pont Airport, Wilmington, Delaware.

WARNER WACO F: Licensed, motor majored, semi-air wheels, tail wheel, Heywood starter, speed ring, steel prop, navigation lights, brakes, duals, $1,500. Szekely Eaglet: New covers, new prop, motor majored, $450. Trade: 35-foot cabin cruiser, to let, galley, sleeps five, beautiful boat; want good licensed ship. B. Fairchild, 402 Ludwig, West Monroe, Louisiana.

WANTED TO BUY OR TRADE

WANTED FOR CASH: Used light airplanes needing engine overhaul and recovering. Fleet, Waco and Aeronca accepted, slightly damaged. No washed-out ships wanted. Hilbert Air Transport, P. O. Box 345, Bristol, Virginia.

WANTED: Waco F parts for cash. For sale: Heywood starters for Warner or Kinner: J-6 used standard pistons, $1 each; new J-5 valve guides, original stock, 95c each; Travel Air wings and tail group. Skyways, Inc., Airport, Cleveland, Ohio.

WILL PAY CASH for Fairchild 22 or Waco F, crackup or ship needing overhaul. King Aircraft Service Co., Municipal Airport, Birmingham, Ala.

WANTED: Lambert 90 'Coupe or similar type ship. Must be priced right and licensed or eligible. Herbert Jacobson, Maurine, South Dakota.

WANTED: Two-place enclosed light plane, two- or three-cylinders. Must be licensed. Have $250 cash. M. Waters, care Alart Motor Co., Horseheads, N. Y.

WANTED: 3 Kinner K-5 front exhaust heads; speed ring for 125 Warner; 2 airwheels, 7:00x4; Continental A-40 engine. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

SPOT CASH PAID for your airplane, motors or parts. Give full information in first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

OLD SHIPS WANTED: Jennies, Standards or similar ships in good shape, in or near condition to fly away. Cash, must be reasonable. AERO DIGEST, Box 2137.

WANTED: Light planes, cracked or in need of repair. State full particulars first letter. M. N. Brann, Vesper Street, South Hempstead, N. Y.

WANTED AT ONCE for cash: Velie M-5 in good shape. Have Szekely 5-cylinder for sale or trade-in on Velie. Joe Pennington, Sanderson, Texas.

WANTED: Seaplane. Will trade Buick club sedan, 90 series, less than year old. This car like new in every detail. Cost $2,700 and has over $300 extras. Prefer small late model ship. Must be in perfect condition. Send complete description and photo first letter. Bob Evans, 713 New York St., West Palm Beach, Florida.

WILL TRADE WACO 10: Tank 63 engine, licensed to September 1936, as part payment on 4- or 6-place cabin with complete night flying equipment. LaFleur Airport, Northampton, Mass.

WANTED AT ONCE: 10 airplanes for cash, regardless of condition. Give full information in first letter. Glenn Fellows, Box 66, Jackson, Mich.

WANTED: Waco F. Complete set Stearman C-3-B wings less ailerons. J-5 crankcase and crankshaft. J-5 motor. 10-inch bench grinder. Greer Flying Service, Municipal Airport, Memphis, Tennessee.

WANTED: J-5 Lockheed. Sell or trade four-place Bird, excellent condition, many extras. J6-7 engine for sale. AERO DIGEST, Box 2131.

WANTED: New or used LeBlond "60" motor. State hours, condition, price, etc. Will buy or trade in LeBlond with broken crankshaft on deal. AERO DIGEST, Box 2157.

WANTED: Jacobs-powered Waco F-2; also, 1934 or '35 Monocoupe. Complete details. For Sale: Waco "A." late '33 Jacobs, no time since major; radio, bank and turn. Heywood starter, wheel pants. speed ring, yellow fuselage, green wings, excellent condition. Price, $2,650. Great Lakes 2-T-1, licensed September 1936; Airwheels, wings and tail surfaces just recovered; excellent condition, $950. Straightwing Waco, 175 h.p. Wright J-6, 15:00 hours since majored and modernized; electric starter; tail wheel, fuselage recovered high lustre finish; real buy, $1,250. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WANTED: Parts or complete undercarriage, also J-5 engine mount for 2000 or 4000 Travel Air. Fast Aero Service, Armstrong Field, Memphis, Tenn.

WANTED: Continental A-40. Give complete details. Have Heath B-4 with starter, throttle, Heath motor mount and gascolator, all in A-1 condition. Bargain. Edward Molitor, 101 Storer Avenue, Pelham, New York.

WANTED: 6- or 8-place used seaplane or amphibion. Must be cheap. $2,500 cash, balance one year. Insured. Preferably with spare engine. Specify all details. Nord-Norges Aero, Narvik, Norway.

POSITIONS WANTED

TRANSPORT PILOT: Ten years commercial experience, including aerial surveying. 3200 hours. Will go anywhere, any country. AERO DIGEST, Box 2136.

MECHANIC: Licensed, A & E. Experienced rebuilding, overhaul, also airline work. Age 30. Single, sober, reliable. A-1 references. Go anywhere. E. H. Doty, Cygnet, Ohio.

TRANSPORT PILOT: Age 22. 1500 hours. 8 years of experience. 1. 1A. 2A and 3B ratings. 175 hours trimotor time. Consider anything, go any place. AERO DIGEST, Box 2135.

YOUNG MAN: 25 years old, 7 years civilian, army experience in servicing and repair of aircraft. Air Corps Technical School graduate. Reliable. Consider anything. Available October 25th. Prefer East. AERO DIGEST, Box 2138.

TRANSPORT PILOT: 3500 hours, 28, single; have 1, 2A, 3A ratings. Will go anywhere. Three years barnstorming experience. AERO DIGEST, Box 2140.

TRANSPORT PILOT: 1500 hours; experienced in all phases of commercial aviation, single, age 24; salary secondary. will go anywhere. AERO DIGEST, Box 2158.

AIRPLANE MECHANIC for over 20 years. transport pilot, flying since 1920. Operated approved repair station. Experienced all kinds of aircraft repairs. Expert welder, woodworker, spray painter, rigger, assemblyman. Wants job as mechanic, pilot or combination of both. AERO DIGEST, Box 2159.

AMBITIOUS YOUNG L.C. pilot, with office training, desires position with airport; wages not paramount issue. Willing to go anywhere. Make me an offer. AERO DIGEST, Box 2161.

PARACHUTES FOR SALE

PARACHUTES: Approved type. Seat, back, lap and chest; bought and sold. exchanged. repaired. Tell all first letter. Professional parachute jumpers and balloonists furnished for all occasions. Thompson Brothers Balloon and Parachute Co., Aurora, Illinois. Established 1903.

IRVING 24-foot seat parachute, white silk. Never been jumped. Perfect condition. A bargain at $80. May be inspected. Dr. R. G. Provost, 119 Hillman St., New Bedford, Mass.

2 EXCELLENT Russell Parachutes: 24 foot, seat pack, pure white Japanese silk, including carrying bags; quick sale, $50 and $60. Shipped unpacked for your inspection. Michigan Aero Motors, Jackson, Michigan.

28-FOOT RUSSELL white silk seat pack, very good condition. A bargain at $55 cash, no reduction. United Aero Corporation, P. O. Box 222, San Antonio, Texas.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

WACO TEN WINGS and parts. Command-Air fuselage, cowling, landing gear. Good J4-B motor. Hisso Eaglerock, slightly damaged, all or parts. Charley Raudabaugh, 13210 French, Detroit, Mich.

BIRD: Factory built spare and component parts. Approved Station No. 254. Speed Bird Corporation, Church and Front Streets, Keyport, New Jersey.

FOR SALE: Westport remote control radio, complete; six tubes, phones, battery and antenna. $35. Also J-5 exhaust manifold, new. Bomar, Sky Harbor Airport, Murfreesboro, Tennessee.

CAMERA: Eastman Hawkeye Aerial; L type, not hand camera, 10″ focal, F 4.5, with lens and two magazines; uses 4x5 plates or cut film. Price, $65; original price, $600. Henry K. Fort Company, 2227 N. American St., Philadelphia, Pennsylvania.

J-5 PROPELLERS: Three Standard Steel propellers, one new, others not used since last etched; same as new. Harry W. Generous, Brainard Field, Hartford, Connecticut.

DON'T BUY ANYTHING until you get Ort's 1935 Aviation Material Catalog. Prices are lower. Send one thin dime today. Karl Ort, 628 W. Poplar St., York, Pennsylvania.

WAR RELICS for clubhouse or den. Vickers aircraft machine guns; cost government $700; rendered unserviceable without marring. Only $7.75 each f.o.b. New York. Sent C.O.D. on payment of $1. Weight 33 pounds. Fiala Outfits, 47 Warren Street, New York, N. Y.

IF IT FLIES WE HAVE IT: Weather-proof Navy flying suits with zippers front and legs (cost $20), $3.75. 10 x 3, 500 x 3, 500 x 4, 14 x 3 tire and tube, $5; wheels, $3.50. 24 x 4, 26 x 3-4-5, 28 x 4 straight side non-skid tire, $3.50 each. Larger size, $5 each. All sizes wheels from $1 to $3 each. Standard steel propellers, all sizes, 50 to $150. Variable pitch Hamilton propeller, best offer. Motors and parts for Wright Cyclone model R-1820 F. Wasp, Hornet, Liberty, Hissos, OX-5, OXX-6, Hall Scott, Mercedes, Whirlwind and other makes of air-cooled motors. New Siemens-Halske 5-cylinder radial motors, in original crates, 70 h.p., $250. New B.G. 4-B spark plugs, 50c. AC, Champion, Splitdorf, 25c. Motor generators, 10 volts input, 300 volts output, $10. New Fahrenheit temperature gauges, 12′, $1.90. 3½″ dial, new altimeters, $3. Tachometers, $7.50. GE compass, $5. Oil and fuel gauges, $1 each. B 2-3-4 engine throttles, $2 to $3.50. Engine primers, choke controls, 50c. Scintilla, Bosch 2-to-12 cylinder magnetos, $25. Seven ignition wrenches in case, 25c set. White silk Irvin parachute with pack, $75. Turnbuckles, shackles, clevis pins, nickel steel bolts, large quantity exceptionally low prices. We carry everything for airplanes. See us for bargains. Crawford Airplane Supply Company, Venice, California.

"FLIGHTEX" Wing Covers: Command-Aire, Eagle, Swallow, Travel Air, Waco, etc., $10. Fuselage covers, $12. Others proportionately. OX-5, OXX-6 parts bought and sold. Ostergaard Aircraft, Parr, Indiana.

AIRWHEELS: Goodyears, 26 x 11-6, complete with adapters to fit 1½/2 x 6 axle. Bronze bushed. Tubes perfect. Casings not so hot. Best reasonable offer. Ray Hegy, Neillsville, Wisconsin. S & B Sales Co.

J-5 HUB with nuts, $20; F-141 direct electric starter, $75; NAR-3 Stromberg carburetors. MN7D, MN7DF Scintilla magnetos, $10. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

AMERICAN CIRRUS MOTOR, like new. Total 50 hours, $275. Set 700 x 5 air wheels, brakes, like new, $50. 121 S. Dickerson Ave., Detroit, Mich.

FOR SALE: Airwheels, 6.50 x 10, brakes, tires and tubes. Complete tailwheel assembly, 10 x 3. Waco F tail group, good condition. C. A. Moore, Jr., Lexington, Mississippi.

LICENSABLE EAGLEROCK center section parts: Fuselage, $50; wings, $25; struts, $3.50; ailerons, $5; other parts priced accordingly. Type PN5-D Scintilla magnetos, $10. Kinner K-5 crankshaft, $30. Excellent OX-5 Millers, $32.50. Renfro Airport, Hereford, Texas.

J-5 ENGINE: 12 hours since major, $225. Hamilton propeller for same, $55. New collector ring, $25; complete outfit, $315. 2 Irving seat pack chutes, new packs, $65 each; both, $105; shipped unpacked, subject to inspection. John Adams, 112 So. Whitney, Hartford, Connecticut.

CHALLENGER MOTOR, parts for Challenger, J-5, Kinner, etc. Props: J-5 and J6-7, $70; both, $130. J-5 prop nuts and wrenches. Thermopete oil heater, $8. Waxfree dope remover, $2 gal. OX-5 mags, $5. Fledgling tailskid yokes, bronze, and landing gear rubbers. Other Fledgling and Travel Air parts. Write needs. We buy used engines and parts. Davis Aircraft Salvage Co., 112 Bay Avenue, Springfield Gardens, New York.

FIRST $35 TAKES one set developing reels and three nesting tanks for eight-inch film, all Monel metal. Valley Airways, Inc., Photo Division, Winchester, Virginia.

AVRO AVIAN upper wings: $15 each; tail surfaces, $15. All sizes shock cord, 2½c foot. Late type Lycoming pistons, cylinders, heavy type shaft. J-5 shaft, pistons, cylinders, numerous small parts. Jerry Kelsey, Philadelphia Municipal Airport, Philadelphia, Penna.

LANDING GEAR V'S, wings, other parts: Travel Air, American Eagle, Swallow, Command-Aire, Stearman, Eaglerock, Klemm. Steel propellers, tractor or pusher: Wasp, J-5, J-6, Challenger, others. Wood props: all sizes. 5.00x4 oleo tailwheel assembly. Tubing, wheels, starters, generators, Robin fuselage, J-5's, oleos, instruments. Licensed OXX-6 Swallow, $350. Terms, trades, delivery. AERO DIGEST, Box 2150.

INSTRUMENTS OVERHAULED: Six months' guarantee. Airspeeds, $5. Altimeters, $3.50 up. Compasses, $8.50. Gauges, $1 to $6. Rate of climbs, $7.50 to $12. Tachometers, $3.75. Turn indicators, $10 to $15. Special rates quoted without guarantee. All estimates free of charge. Discounts made to airport operators. Write for detailed price list. Aviation Salvage Company, 6111 South Menard Avenue, Chicago, Illinois.

WARNER PARTS: Crankshaft, master rod assembly, pistons, crankcase, induction housing, magnetos, carburetors and many other parts. Parrish Flying Service, Columbia, South Carolina.

EDO FLOATS for Aeronca C3. Used 50 hours; complete with all struts, water rudder, etc. Make best offer first letter. Will ship subject inspection. Warner Flying Service, Saginaw, Michigan.

J-5 ENGINE, 80 hours since major overhaul. $365. Pioneer bank and turn, large type. $45. J-6 Standard Steel propeller, 20 hours since factory reconditioned, $75. Radio receiver, $45. Trimm headphones, new, $4.50 each. Set Pyle navigation lights, $2.50. Pistol and two flares, $37.50. New 14 x 3 tire, $4.50. Velie Cavalier, uncovered, motor down, as is, $185. OX-5 Swallow; wings and part of tail group needs recover, $250. Cirrus parts. C. R. Nuckols, Box 53, Oklahoma City, Oklahoma.

KINNER K-5 used parts; new and used English Cirrus parts for sale. Completely overhauled OX-5 and OXX-6 engines, especially good condition and priced for quick sale. Lester J. Sipe, Box 118, York, Pennsylvania.

FOR SALE: Used Lycoming motor parts. One pair landing lights. One pair 29 x 13 x 5 airwheels, brakes. One pair 25 x 11 x 4 airwheels, brakes. Write for list. L. P. Quinn, 1623 Ogden, Denver, Colorado.

COMPLETE TAIL GROUP: Wing struts and landing gear for Alexander Flyabout. Licensed Genet 80 propeller. British "Scorpion" 40 h.p. lightplane motor. Long Aircraft, Cornelius, Oregon.

FOR SALE: New British Cirrus engines, Mark II and III. Complete line of miscellaneous new and used parts. A. F. Helsten, 829 So. Flower St., Inglewood, California.

CLEARANCE SALE OF WINGS: Wacos 10, J-5, F; Travel Air 2000; American Eagle; Swallow 3-place. Spars, ribs, covers made to order. Special on dope. N. L. Aircraft Co., Vermilion, Ohio.

MISCELLANEOUS SERVICES, OPPORTUNITIES, OFFERS, ETC.

FOR SALE OR LEASE at reasonable terms: Buildings and adequate runways, built especially for aircraft manufacturing by Emsco Aircraft Corporation, Los Angeles, Calif. For further information, address R. C. Baker, Jr., P. O. Box 609, Huntington Park, California.

LEARN TO FLY: $6 per hour. No down payment; no clubs; no dues. Pay only as you fly. Aeronca dealer. Goodwill Air Service, Madeira Airport, Bernharts P. O., Reading, Penna.

THE BENNETT PLAN places new airplane in operation for you. Ideal for flying clubs, also for pilots wishing to start in business. Little or no capital necessary. Write Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey.

SEAPLANE OPERATORS wishing to operate in Florida: Can use several different types of ships on percentage basis. Write describing type of ship you have. AERO DIGEST, Box 2139.

YOU CAN EARN $40 to $100 weekly, flying in your community. We train you and help start you in business. Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey.

FOR RENT: New Alexandria, Penna., Airport. 65 acres, 50 x 100 tin hangar. On U. S. Route No. 22, 35 miles east of Pittsburgh. A. C. Barker, Morgantown, West Virginia.

TRANSPORT PILOT GOING SOUTH for winter with several planes. Have room for four Students, at $1,450 each. Students will receive enough flying time for transport license, along with room and meals. AERO DIGEST, Box 2144.

AIRPORT OPERATORS: We are distributors and have in stock new Taylor Cubs and Rearwin Sportsters available for demonstration and delivery to your customers. Sign up for agency now. Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey.

A REAL OPPORTUNITY: Young man desires a partner for barnstorming tour by November 1. State experience and ready cash in first letter. AERO DIGEST, Box 2162.

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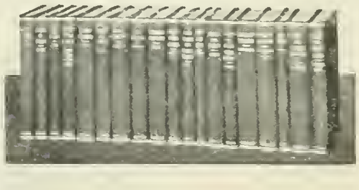

Can you answer these questions **?**

The compass reading is 230°, the variation is 18° E, the deviation is 7° W. Determine the true heading.

What is meant by compression ratio and how does it affect the power rating of an engine?

What would you do to get a plane out of a tail-spin?

What is the purpose of a condenser in the ignition system? In which circuit is it located?

How is the torque of the propeller balanced in rigging a plane? Why is the vertical fin sometimes slightly offset?

What are 8 significant landmarks that are shown on good avigation maps which may be identified easily from the air?

What is the approximate error in the air speed reading for an increase in elevation of 3,000 ft.?

If your engine started missing on one cylinder, where would you look for the trouble?

What is the effect of having an adjustable stabilizer too high when landing?

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This book will help you to pass any license test:

Aeronautics

A Ground School Textbook

by HILTON F. LUSK

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THERE is nothing specially difficult about the above questions, you should be able to answer any of them without hesitation if you are prepared to pass the written part of the government license examinations. They are selected at random from the 224 test questions contained in Lusk's famous ground school textbook, Aeronautics. These questions are typical of those that have been asked in examinations for the Department of Commerce transport pilot's license, with the addition of others to aid you in testing whether you have really grasped the information contained in the book.

From this book you can obtain just the information you need if you are looking for a government license as a pilot in any of the grades, or as a mechanic. Although it is designed primarily for use in ground schools, as well as in colleges and technical schools giving aeronautic courses, it is so clearly written that it also ideally meets the needs of the man who must acquire his technical grounding in aviation by home study.

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Blind Flying Instruments: Use of attitude instruments in blind flying. Absolute and relative references. Inclinometers. Pitch, roll, turn indicators. Operating principles of gyroscopic instruments.

Engine Instruments: Construction and operation of tachometers, pressure gages, thermometers, fuel quantity gages, etc.

Safety Appliances: Parachutes. Aircraft radio, antenna details, shielding methods, etc.; radio range-beacons and markers.

Avigation Maps and Piloting: Explains and illustrates various map projections and their use in avigation. Practical hints on piloting.

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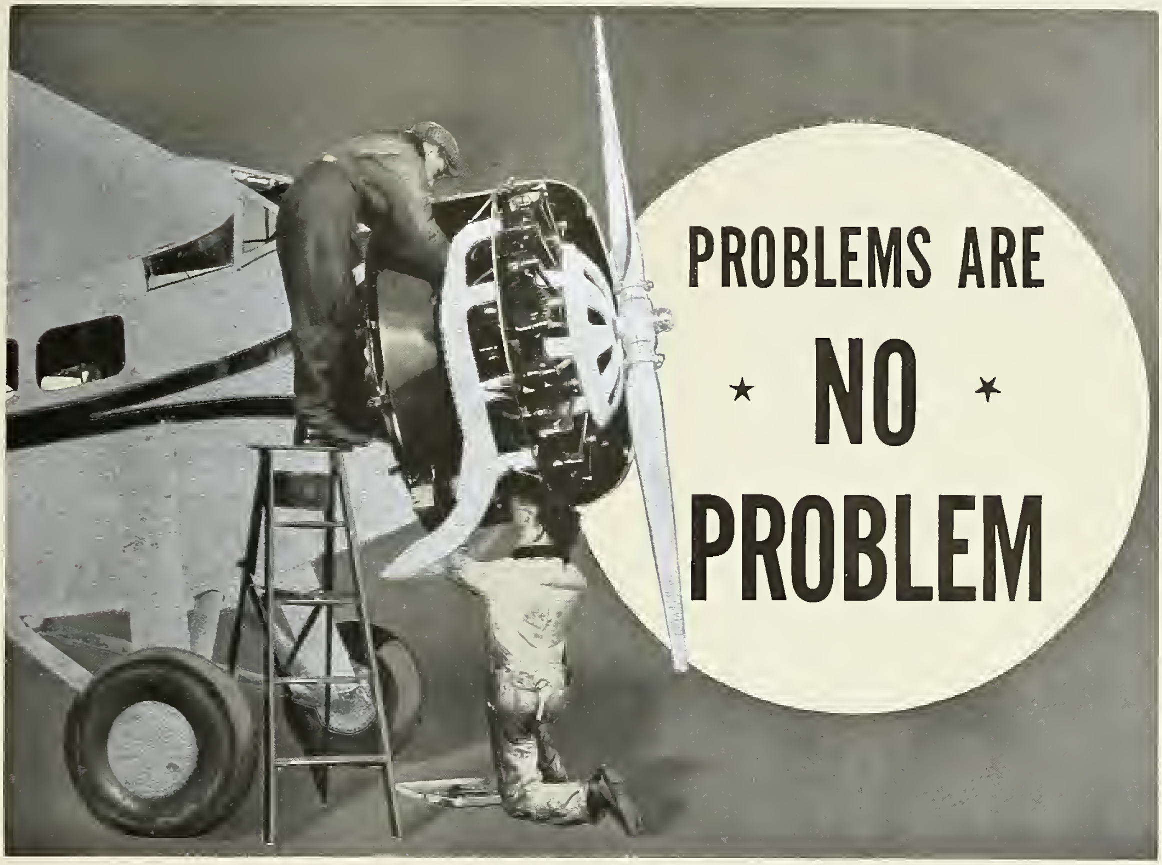

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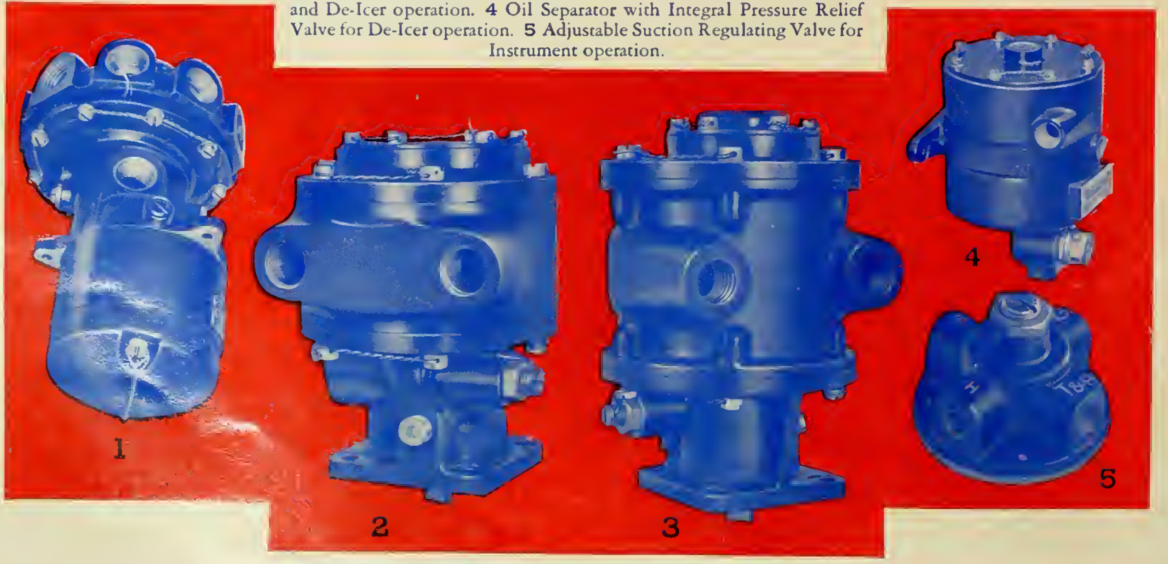

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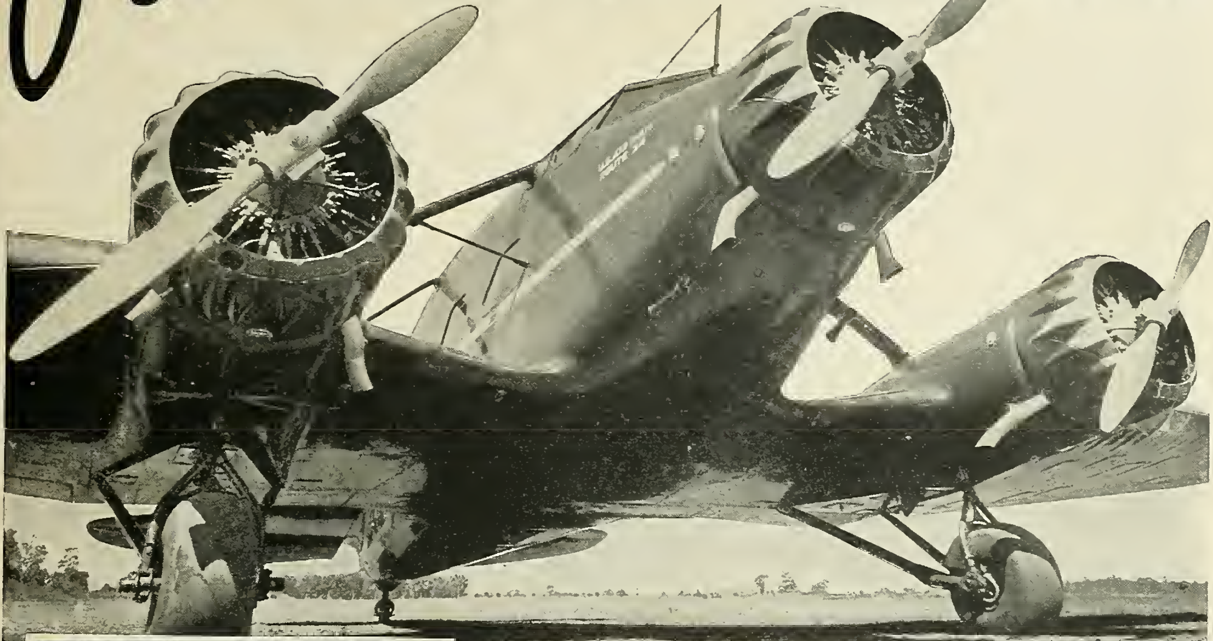

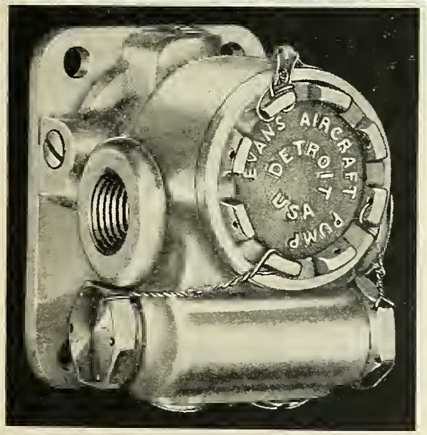

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Volume 27. *Number* 5

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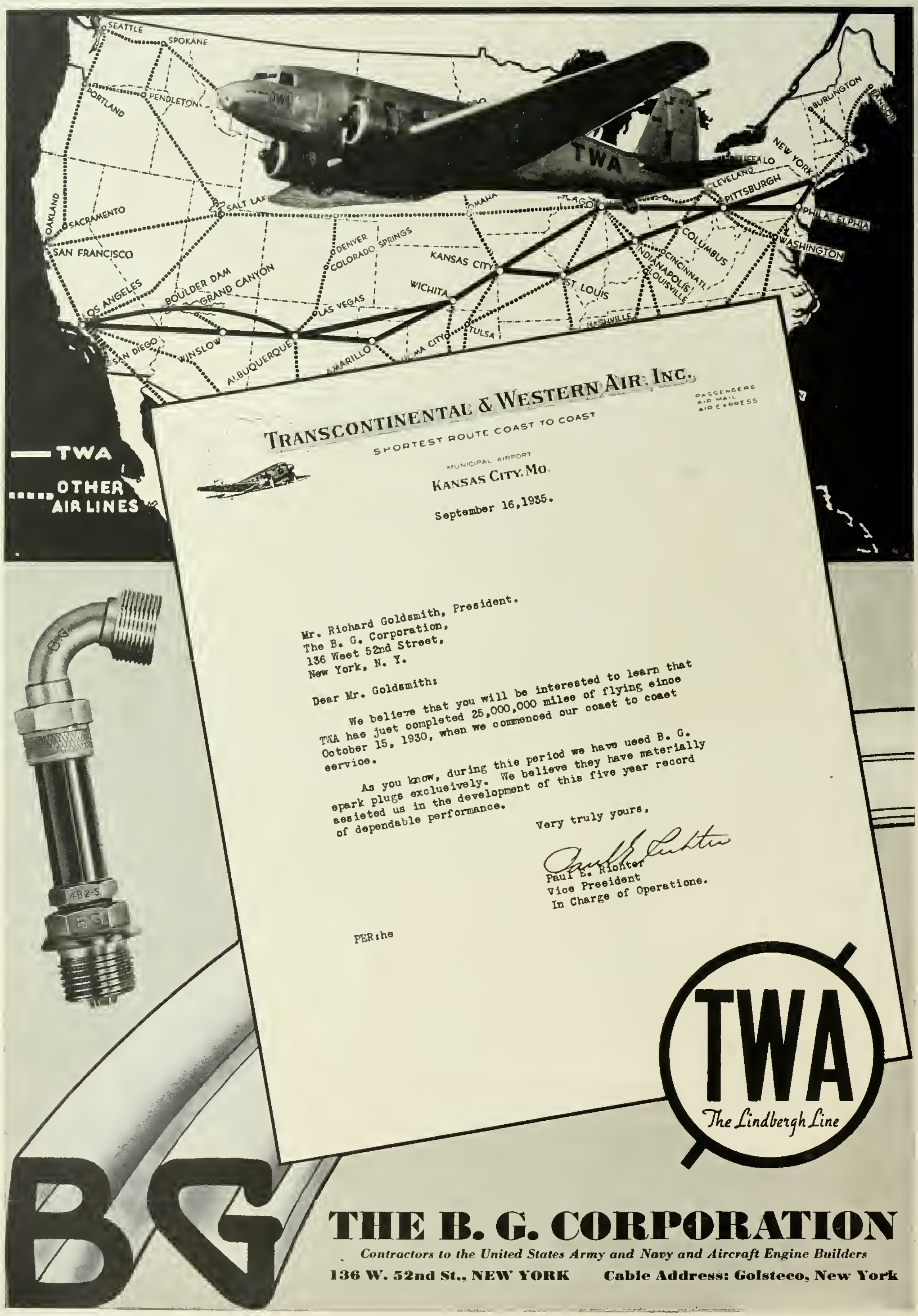

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We believe that you will be interested to learn that TWA has just completed 25,000,000 miles of flying since October 15, 1930, when we commenced our coast to coast service.

As you know, during this period we have used B. G. spark plugs exclusively. We believe they have materially assisted us in the development of this five year record of dependable performance.

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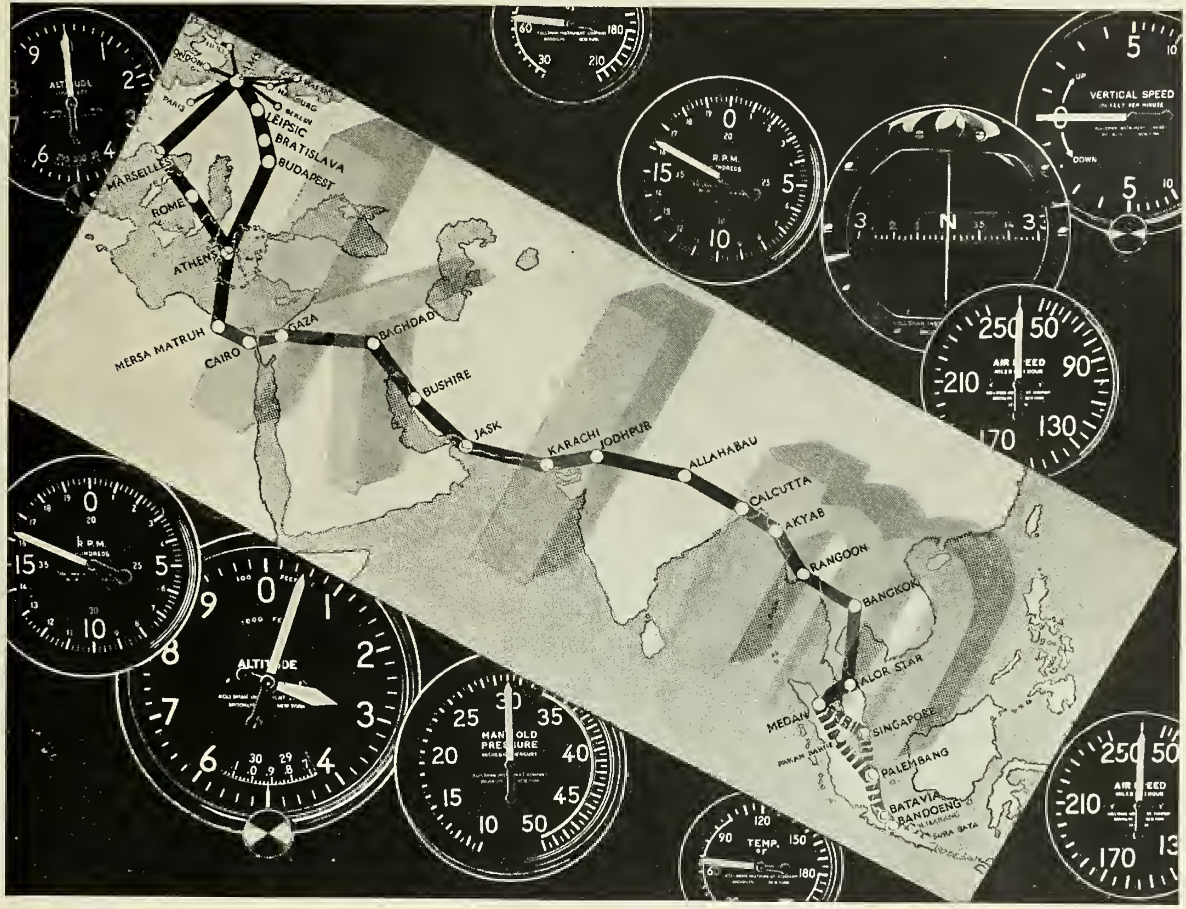

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Beechcraft is now available with Edo Floats. It was officially approved as a seaplane last month.

While this is important news to the many friends of Beechcraft whose flying calls for a seaplane, the sensational part of the story is:

Beechcraft, Model B17L (powered by a 225 h.p. Jacobs), is the first land plane to be licensed as a seaplane without the loss of any of its original useful load.

The Beechcraft seaplane will carry *a legal load* of five persons, fifty gallons of gasoline, seventy-five pounds of baggage and have an additional allowance of seventy pounds for special equipment or instruments.

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B17R—With a 420 h.p. Wright Whirlwind; uses 285 h.p. when cruising; cruising speed 202 m.p.h. at 9,000 ft. Landing speed, 50 m.p.h.

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B17L—Jacobs powered, 225 h.p.; lands at 45 m.p.h.; cruising speed at 7,200 ft., 166 m.p.h.

Compare this useful load with that of any other seaplane of less than 400 h.p.

In spite of the fact that seaplane equipment slightly reduces Beechcraft's outstanding performance, model B17L still outperforms any other airplane of similar power. Compare the 225 h.p. Beechcraft's 133 m.p.h. cruising speed with the cruising speed of any land plane in its power class.

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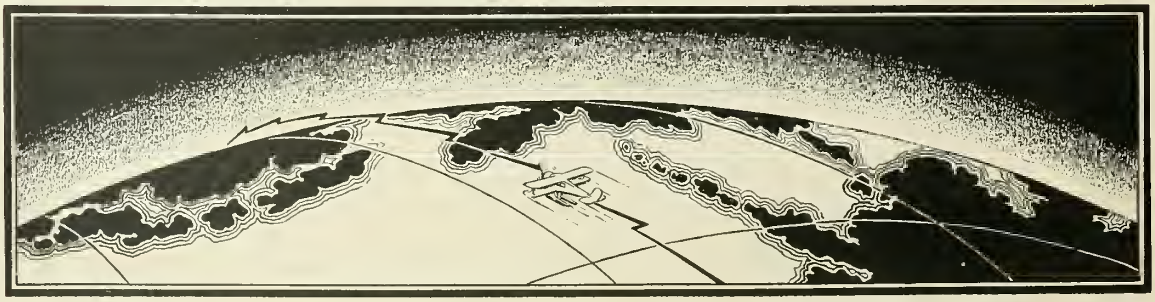

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The aeronautical engineer renders a valuable service to aviation and so wins recognition, prestige and rewards which are paid for constructive efforts.

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The first step is to secure training . . . Training that is approved and recommended . . . Training that will provide practical thinking and build up ability and usefulness in the profession. Parks Air College offers you this type of training in its Aeronautical Engineering School. This School is given recognition and accredited standing by the Superintendent of Public Instruction of the State of Illinois.

INVESTIGATE PARKS AS OTHERS HAVE DONE

If you want to make a career for yourself in the Aeronautical Engineering field, you will want to investigate thoroughly, as did the 80 Engineering students now enrolled, the training offered you by Parks Air College.

A Father (name on request), an American who lives in China, whose son is now enrolled in Engineering, wrote about his investigation as follows:

"You will not be surprised to hear that when my son told us he was interested in Parks, I made certain enquiries out here as to the status of Parks. My enquiries were made at the U. S. Consulate General in Shanghai, and also at the U. S. Treasury and other government officials out here who were able to give me an unbiased report on Parks. Needless to say, these reports merely served to confirm that my son had made a wise choice in selecting Parks rather than some other college offering more or less a similar course."

Interesting Facts About PARKS AIR COLLEGE

Founded August 1, 1927.

Offers you training of college and professional school rank, majoring in Aviation.

Offers three 2-year courses leading to B. S. degrees in Aeronautical Engineering, Aviation Administration, Aviation Mechanics.

Accredited by the Illinois Superintendent of Public Instruction.

Owns its own airport of 100 acres.

Has plant of 14 buildings with extensive laboratory and shop equipment, all devoted to school purposes.

Has fleet of 10 training planes.

Offers complete course in radio beam and instrument flying.

Offers *airline piloting* experience as part of flight training.

Faculty of 25 composed of specialists in various departments of aviation.

A total personnel of 80.

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80,120 hours' flight training experience.

1,482 planes and 432 engines repaired and rebuilt in shops.

Graduates with every leading aeronautical concern in America and in many foreign countries.

Fully approved as a Transport and Mechanics School by the U. S. Department of Commerce.

This is one of the two drafting rooms used by Aeronautical Engineering students at Parks Air College. In this room each student has an individual drafting table.

Each Engineering student secures three terms' work in the practical and theoretical maintenance of planes, during which he becomes acquainted, through actual experience, with the characteristics of materials used in aircraft construction.

Another Father (name on request), living in Indiana, after making a very extensive personal investigation, enrolled his son in the Engineering School and wrote:

"I think you gentlemen are engaged in a wonderful and constructive work, Mr. Parks, and I know that it must be a source of great satisfaction to all of you to know that you are contributing so much and so well to America's newest, and possibly some day, one of her largest industries.

"I shall be very proud to commit my son to your care and training for two very vital years of a promising career."

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Possibly you have decided that your personal aptitudes better qualify you to enter one of the other fields in aviation: Piloting, Business or Maintenance.

If so you will be glad to know that training offered by Parks in other major courses is just as complete in these fields as is the training of the Engineering Course in the Engineering field.

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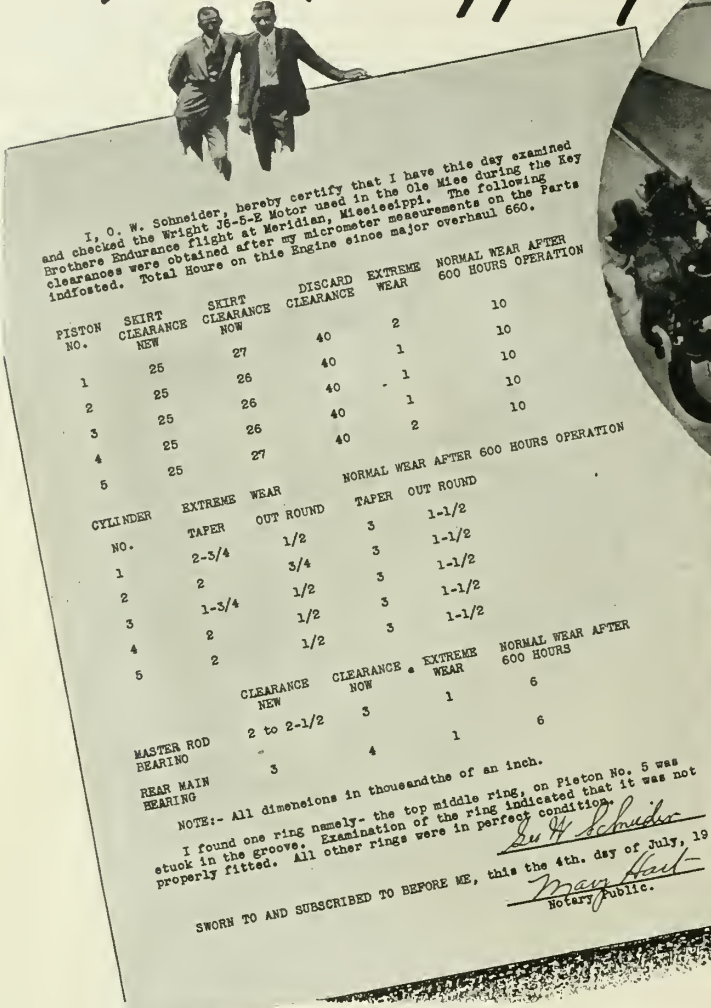
...without stopping*



I, O. W. Schneider, hereby certify that I have this day examined and checked the Wright J6-5-E Motor used in the Ole Miss during the Key Brothers Endurance flight at Meridian, Mississippi. The following clearances were obtained after my micrometer measurements on the Parts indicated. Total Hours on this Engine since major overhaul 660.

PISTON NO.	SKIRT CLEARANCE NEW	SKIRT CLEARANCE NOW	DISCARD CLEARANCE	EXTREME WEAR	NORMAL WEAR AFTER 600 HOURS OPERATION
1	25	27	40	2	10
2	25	26	40	1	10
3	25	26	40	1	10
4	25	26	40	1	10
5	25	27	40	2	10

CYLINDER	EXTREME WEAR		NORMAL WEAR AFTER 600 HOURS OPERATION	
NO.	TAPER	OUT ROUND	TAPER	OUT ROUND
1	2-3/4	1/2	3	1-1/2
2	2	3/4	3	1-1/2
3	1-3/4	1/2	3	1-1/2
4	2	1/2	3	1-1/2
5	2	1/2	3	1-1/2

	CLEARANCE NEW	CLEARANCE NOW	EXTREME WEAR	NORMAL WEAR AFTER 600 HOURS
MASTER ROD BEARING	2 to 2-1/2	3	1	6
REAR MAIN BEARING	3	4	1	6

NOTE:- All dimensions in thousandths of an inch.

I found one ring namely- the top middle ring, on Piston No. 5 was stuck in the groove. Examination of the ring indicated that it was not properly fitted. All other rings were in perfect condition.

Geo W Schneider

SWORN TO AND SUBSCRIBED TO BEFORE ME, this the 4th. day of July, 19

May Hart
Notary Public.

that's what Fred and Al Key virtually did... and here is the report to prove what Ring-free did

George W. Schneider, manager of motor overhaul department of Delta Airline, was named by Wright Aeronautical Corporation to inspect the motor thoroughly. Astonished by his first figures, Mr. Schneider again micrometered all parts of the motor.

More than 51,000 air miles (58,860,000 revolutions)... virtually twice 'round the world! That's how far Fred and Al Key of Meridian, Mississippi, flew the "Ole Miss" to set their endurance flight record. For 653 hours, 34 minutes, their Wright Whirlwind Motor droned through the sky... without even a spark plug changed!

What would you expect to happen to pistons, piston rings, cylinders and bearings of that motor during such a gruelling flight? Yet, read Mr. George Schneider's report above. Note what it says about the piston rings. Check the amount of wear on pistons, cylinders and bearings. They show an amazing new record of lubrication efficiency: *less than half* the normal expected wear! What's more, oil consumption remained at only 3 pints per hour during the flight, while gasoline consumption did not increase at all.

Here is perfect proof that Macmillan Ring-free Motor Oil lubricates better, reduces friction and *friction wear* and prevents the formation of harmful carbon. If you want to reduce maintenance costs on your motor... use Ring-free.

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These courses are recommended and approved by many state aviation officials, prominent pilots and leaders in the field of aeronautic education. . . . Educational officials and instructors are invited to write for complete information. . . . These are no correspondence courses, but may be used for home study.

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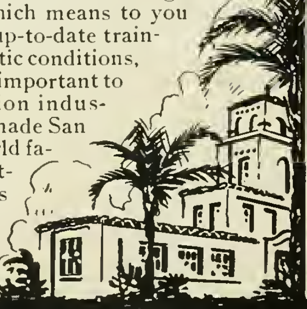

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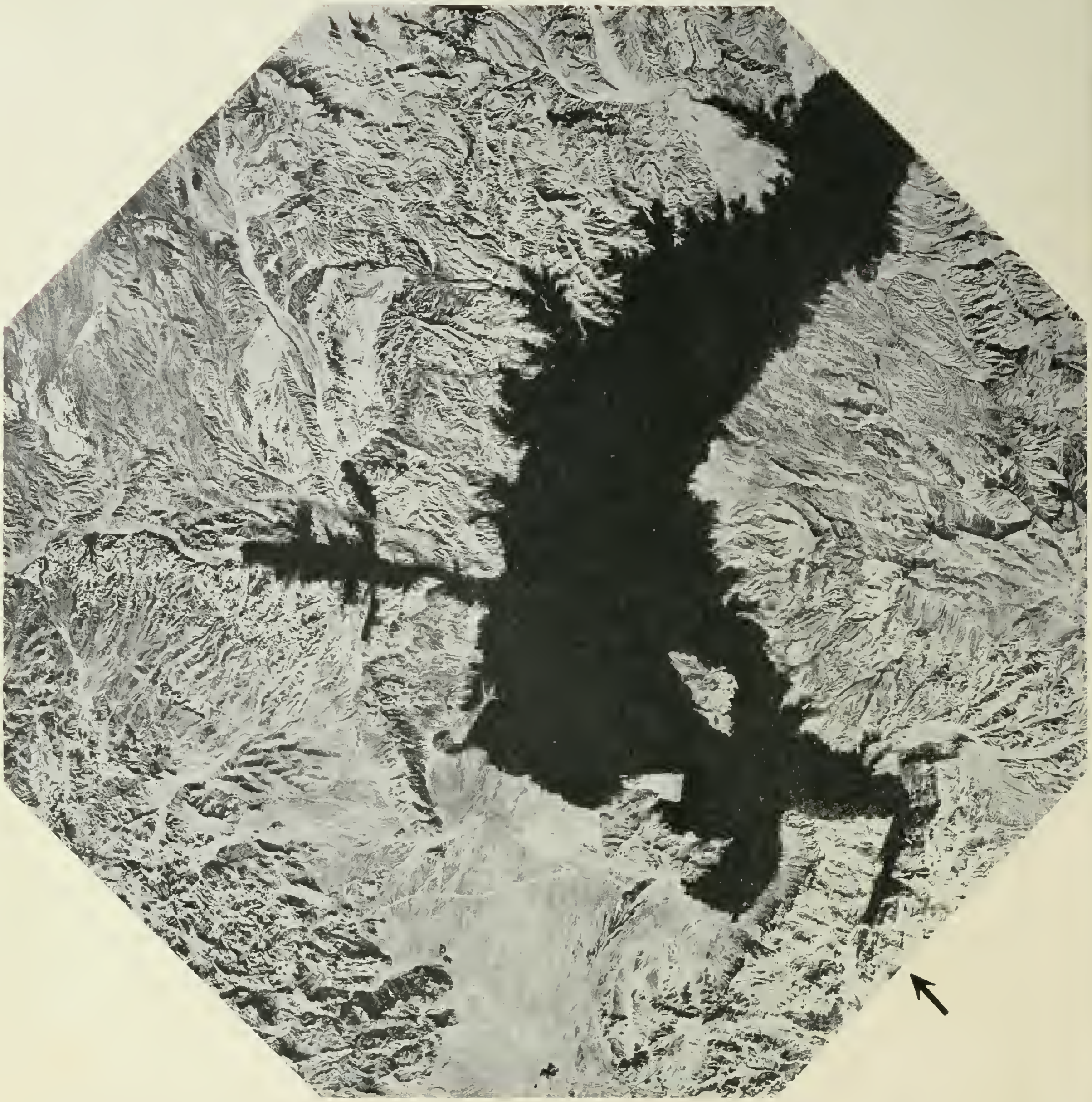
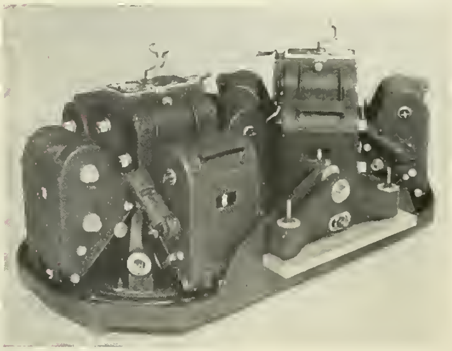


200 square miles of territory surrounding Boulder Dam (arrow) and Lake are seen in this photograph made by Fairchild Aerial Surveys of California during a survey for the Soil Conservation Service



Left: The Fairchild 10-lens compound camera with which the octagonal photograph was made. Right: Another view of Boulder Dam

AIR
HOT AND OTHERWISE

●

FRANK A. TICHENOR

● The aviation record of this administration can be written in one word, spelled M-E-S-S. Mr. Roosevelt and his bright boys in Congress, and in the Department of Commerce, kept their promise all right —they gave us a New Deal. But what a Deal! Every single card has been marked, and every single card has weakened aviation's hand in the industrial game.

Right from the start—from Roosevelt's first summer in the White House—aviation has been whirling in a maelstrom of government ignorance, interference, investigations, dishonored agreements and incompetence. If it weren't true, if nearly everyone in aviation hadn't been a victim some place along the firing line, it would be impossible to believe that such malignant stupidity could thrive in the Government of these United States. Stupidity, yes—but that's putting it mildly. More to the point, call it malicious ignorance, vicious politics and bureaucracy gone hog wild. No one can calculate how much damage to aviation's progress has been wrought by these meddling ignoramuses. But everyone in the industry knows—and knows well—that real progress is impossible as long as the Government insists on sticking its finger in every pie.

The history of American achievement is one of private initiative. The history of industrial degeneration, in those cases where it has become chronic, is the history of government meddling. Look at the railroads. Look at the Merchant Marine. The same fate threatens aviation. It will surely befall us unless we call a halt right now on political tampering.

Look back at all the balls and chains the Administration has encumbered aviation with. The wonder is that it has advanced at all during the last two and a half years. First the N.R.A. with its hordes of bureaucrats telling everyone how to run his business—whom he could employ, and when and how long, and for how much. Codes, codes, codes. A gigantic effort to emasculate competition —to kill the most powerful incentive to progress.

Then the vicious Black investigation. A self-opinionated Senator, a Roosevelt flunkey, making cannon fodder of the reputations of inspired men who had created America's great air transport system—all for the sake of his own selfish political ends. A petty politician ignorant of the most elementary problems of air transportation sitting in judgment upon and besmirching the work of competent, earnest men who knew their jobs on both the technical and business sides and who had proved themselves fully aware of their responsibility to the flying public. How much do you think the heckling of Senator Black—what an apt name for a man whose greatest joy seems to be to blacken the good names of others!—how much do you think the paroxysms of this head (line) hunter inspired America's airline builders to carry on the advancement of a great system of transportation?

Next came the Department of Commerce's notorious attempt to intrude upon the field of private airplane manufacturing with its silly $700 airplane fiasco. Little officials trying to make big names for themselves, even though they nearly wrecked the market for private aircraft. Men who had never been successful in any commercial aviation venture discrediting, by means of their public position, the business sense of manufacturers turning out sound products on the only financially feasible basis possible at the present time. Men who should have been minding their P's and Q's and maintaining the semi-judicial prestige of their Department, as their more sincere predecessors had done. Do you think it was easy for the private manufacturers to go on improving their ships with these bureaucrats barking at the heels of their prospects about "foolproof" airplanes at $700?

No sooner had this $700 airplane nonsense begun to subside a little than Freebooter Farley pulled that most dastardly of all New Deal deeds—the air mail cancellations. Valid contracts thrown in the scrap heap on the political whim of an all-mighty Patronagemaster General. Blanket conviction of all air mail contractors without even the semblance of a trial—a violation of the most fundamental rights of an American citizen. What courage, what faith in aviation must those airline operators have to go on increasing the safety and efficiency of their equipment, as they are doing, in the face of a Government which does not regard its own word as binding and which resorts to black-balling respectable persons in order to bend them to its will!

Then the Baker Board investigation of the Air Corps and the long hearings of the Federal Aviation Commission. More false promises—the promise that the Commission would straighten everything out, only to have the President ignore its fine, constructive recommendations. The only investigation during the entire Administration conducted by anything resembling aviation experts—and their exhaustive report treated like a scrap of paper and virtually thrown out the window. Meanwhile, an industry in suspense for months and months, hoping against hope for a true new deal from the New Dealers. We should have known better than to expect decency from an Administration which has distinguished itself more by its bad faith and arrogance than anything else. We should have known that the promise of the Federal Aviation Commission would not be kept!

Then the Senate munitions investigation under that brilliant advocate of his own pre-established notions—Senator Nye. More reputations blackened, not only among those in our own industry at home, but equally among our customers abroad. Our aircraft export trade almost destroyed as a result. A noble achievement for a Government that brags and boasts of its efforts to revive prosperity.

And now finally, the Senate investigation of the Cutting crash and the Sirovich investigation in the House. More lawyers and petty politicians making political capital out of something they know nothing about. More of the nuisance and expense to the industry of trotting to Washington to testify on this or that when everyone knows only too well that the real experts won't be listened to anyhow.

* * *

We've had enough. We're fed up. We want to be left alone to conduct our business as we see fit, just as the Constitution assures us we have the right to do.

As long as the attention of aviation's leaders is constantly distracted from the job by intimidating investigations, aviation cannot build up to a truly great industry. As long as the Bureau of Air Commerce continues to be a political soapbox instead of the non-political technical guide it was intended to be, the manufacturers can have no confidence to go ahead improving their products and their markets. As long as decent men are branded as crooks when they try to make an honest profit, aviation cannot contribute its share to the nation's wealth or give employment to the thousands that it might. Aviation cannot really progress as long as the Administration's aviation policy is spelled M-E-S-S.

PHYSICAL REACTIONS

● The development of the parachute and its use by fliers exploded old theories that a fall of 100 feet or more produced unconsciousness, or death before the ground was reached. It was soon established, by chance at first, that a free fall in space produces neither unconsciousness nor death. This fact led individuals to make scheduled delayed parachute jumps before public gatherings and other delayed parachute jumps have been made unintentionally in which the jumper had difficulty locating his ripcord or other similar troubles. Unfortunately, the subjective mental or physical reactions that occurred in these jumps was never recorded and so Capt. Harry G. Armstrong, director of the Physiological Research Laboratory, Materiel Division, U. S. Army Air Corps, undertook a series of experiments to gather this data. Besides ascertaining the subjective mental and physical reactions to a free fall in space, Capt. Armstrong desired to observe any unusual phenomena incident to such a fall, and to test the practicability of utilizing delayed parachute jumps as a safety measure.

Writing of his experiences in the subsequent culmination of his tests, Capt. Armstrong, in the *Journal of the American Medical Association,* says that an exact knowledge of these mental and physical reactions is of considerable practical importance as evidenced by the following considerations.

Fear of falling is one of the strongest inherited and acquired self-preservative instincts of man. It is one of the two external factors that produce evidences of fear in new-born infants. This fear is the source of some aircraft accidents, because many airmen choose to stay with a disabled ship and risk a crash rather than take to their parachutes and face the unknown. Others who take to their parachutes cannot resist the fear of a short free fall, pull their ripcord too soon and become entangled with the airplane with consequences that often are fatal. A second situation that calls for a delayed parachute opening is in those cases in which a jump is made from a disabled ship which travels in a circle and collides with the jumper. At other times it is possible to avoid colliding with other jumpers by a suitable delay. Many avoidable accidents have been caused in the past by both these occurrences. The third situation that requires a delayed parachute opening is a jump from extremely high altitudes. It is necessary on altitude flights to use oxygen, since anoxemia (an abnormal condition due to deficient carbon dioxide of the blood) begins to develop at about 10,000 ft., producing dyspnea (difficult or painful breathing) at 15,000, unconsciousness at about 22,000, and death at about 27,000. If it should be necessary to make a parachute jump from 30,000 ft. or above, one would not only abandon the airplane but also his oxygen supply. Were the parachute opened at once, unconsciousness or even death might occur before the relatively slow descent carried the jumper to the lower altitudes where the oxygen pressure is sufficient to maintain life. On the other hand, a free fall from 30,000 ft. to 15,000 ft. would require about 90 seconds, which is less time than is necessary to develop extreme oxygen want.

The next situation applies only to military aviation. Here a ship, disabled in combat, may require its occupants to take to their parachutes. These individuals then become the prey of enemy airmen and are helpless to resist as they float to earth. Their only defense is a strategic quick retreat downward, using the speed and the time element of a free fall to escape.

A 1200-Foot Free Fall

The last situation is of quite recent origin and has developed as a result of modern aircraft performance. Our present parachutes presume a velocity of about 175 ft./sec. or 119 m.p.h. at the time of opening. At that speed the parachute functions smoothly, no undue stresses are set up in either the fabric or the harness, and the opening shock to the jumper is not normally sufficient to produce injury. However, when a man jumps from a plane traveling 250 m.p.h. or one in a dive going 360 m.p.h., he is for a few seconds traveling in the same direction and at the same velocity of the ship. If he should open his parachute at that moment (while traveling 360 m.p.h.), the stresses on the parachute and on the jumper are tripled. This unusual force has, in at least one instance, broken both leg straps and the breast strap of a service-type parachute harness and only the arm loops prevented the pilot from falling to his death. Since the terminal maximum velocity of a human free fall in space is 175 ft./sec., or about 119 m.p.h., sufficient delay would enable a deceleration from say 300 to 120 m.p.h. at which time a safe parachute opening could be made.

Reporting on his experiments, Capt. Armstrong said "The jump was made from the rear cockpit of a two-place biplane. Two standard U. S. Army Air Corps parachutes were worn, one a 28 ft. seat-pack training type, the other a 22 ft. emergency type worn on the abdomen. A summer flying helmet covered the head, but goggles were not used.

"The airplane was flown on a straight and level course at 2200 ft. and at an airspeed of 119 m.p.h. over a given point on the terrain. At a prearranged signal from the pilot, as this point was crossed, I made the jump in the following manner: Standing on the seat of the rear cockpit facing the right side of the airplane, I placed the left foot on the edge of the cockpit, grasped the ripcord of the training parachute with the right hand, and grasped the back of the pilot's seat with the left hand for balancing. The upper part of the trunk was thrown forward and downward, and as the body reached a horizontal position a strong thrust was given with the left leg. This resulted in a slow tumbling fall, the body making one complete revolution every two seconds. During the second and third revolutions of the body, the eyes were voluntarily closed and at the end of that time again opened. Careful note was made of all mental and physical reactions, and sensations until the 1000-ft. limit was reached, at which point the ripcord of the training parachute was pulled and the remaining distance traversed with the parachute open. Two attendants on the ground timed the free fall and from this and a series of photographs calculated the distance of fall."

From experiments with dummies conducted by the Materiel Division, it has been found that a "man equipped with a parachute pack, but allowing it to remain closed, will fall at a maximum rate of between 160 ft./sec. (109 m.p.h.) and 175 ft./sec. (119 m.p.h.) and that he will gain

AND MENTAL TO A FREE FALL

this velocity in about 12 seconds, having fallen 1400 to 1500 ft."

The differences in the terminal velocities were determined to be due to the fact that a tumbling body falls slower than one that falls straight. It was also noted that "the velocity which the airplane imparts to a body diminishes as the velocity (due to gravity) increases, so that the resultant acceleration is not very great. If a man would jump from an airplane which is traveling at 120 m.p.h. he would maintain very closely that same speed until he reached the ground or opened his parachute. If he left the airplane while traveling at a speed greater than 120 m.p.h., his speed would rapidly diminish to that amount."

Evaluating Reactions of a Fall

Applying these data to the case under consideration, it may be calculated that the initial velocity was 175 ft./sec. in a horizontal direction with a terminal velocity of about 149 ft./sec. (102 m.p.h.) in a vertical direction. The time of fall being 11 seconds, the distance (vertical) was approximately 1200 ft. The probable path and rate of fall is shown in the accompanying chart.

To evaluate properly the reactions experienced in this experiment, it is necessary to consider first the physical and mental state during the few seconds preceding the jump. The predominant mental factors at that moment were fear and excitement. The fear was from an irrepressible self-preservative instinct, partly due to the instinctive fear of falling and partly to an acquired fear of fouling the airplane, having a defective parachute or being injured in a faulty landing. The excitement was the result of participating in an undertaking of some danger without previous experience and with unknown consequences.

The other mental attributes were essentially normal, consciousness was unclouded, perception was clear and ideation was rapid, although perceptibly influenced by the excitement.

The physical sensations were normal under the circumstances, the roar of the engine, the sight of the ground below, the roar of the wind past the head and the irritation of the eyes from the slipstream were all true to previous experience. There was no dizziness or nausea, nor loss of spatial or postural sense. The breathing was regular but difficult, owing to the wind blast from the propeller. The heart beat and other bodily processes were not consciously perceptible.

The normal or at least initial state having been established, the reactions of the free fall may now be described.

Mental Reactions

Throughout the free fall, all conscious mental processes seemed normal. As soon as the airplane was cleared, fear and excitement disappeared.

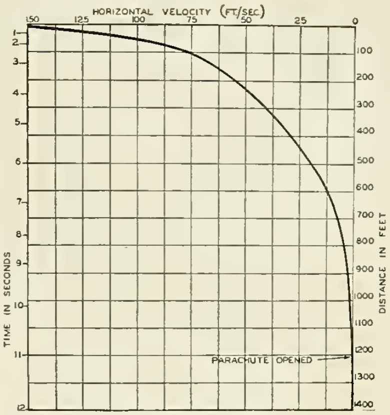
Consciousness was unclouded and ideation was rapid, precise, penetrating and clear.

Perception of an auditory nature may or may not have been impaired. While twelve airplanes were in close proximity to the point at which the jump was made and one circled close to the line of fall, no airplane noise can be recalled. Also it was expected that the rush of air past the ears would produce considerable sound, yet none was noted. Whether this loss of auditory perception was functional, due to lack of attention or because of atmospheric conditions, is not definitely known, the latter, however, being the most likely explanation.

Visual perception was normal. The earth, objects and individuals below and the sky above were normally visible.

There were no consciously perceptible heart beats or other bodily processes.

Probably one of the most interesting observations was in regard to the perception of position and motion in space. At the moment of jumping the earth was in full view. For the first second of fall there was a horizontal velocity of about 175 ft./sec. and a vertical acceleration had been reached of about 16 ft./sec. At the same time there was a tumbling motion of the body making a complete revolution in about two seconds. Of all these motions, acceleration and deceleration, the only one recognized was rotation of the body.



Rate of fall and calculated path taken by Capt. Armstrong during his test jump

During the second second of fall, the horizontal velocity had decreased to about 120 ft./sec. and the vertical acceleration had increased to about 24 ft./sec. and still there was no conscious realization of any movement except the body rotation.

During the third and fourth seconds, the eyes were voluntarily closed and during that time all sense of motion was lost. Here, not only were the linear velocities and accelerations and decelerations, both horizontal and vertical, imperceptible but also the previously recognized body rotation. In short, the sensation was that of being suspended at rest in midair.

When the eyes were opened, which was at an altitude of about 1900 ft. and the ground again sighted, it was then noted that there was for the first time a definite sensation of falling. This sense of fall increased rapidly and at the moment the parachute was opened, (at 1000 ft.) there was fully perceptible vertical velocity lending strong support to the recent theory that the eye and not the ear is the predominant organ in determining spatial position and relationships.

The increased sense of motion (falling) as the ground was approached is explained by a normal lack of sufficient depth perception acuity at high altitude to recognize the shortening of the distance to the earth. As the fall continued, the shortening of the distance became more readily recognizable and the sense of falling increased.

Physical Sensations

The period of free fall was remarkably free from abnormal physical sensations. There was no nausea or vertigo (dizziness), although the author admitted susceptibility to both from any swinging, tumbling motion, or disorientation. In this case the lack of a distinct sense of

(*Continued on page* 71)

UNITED We Stand . . . . DIVIDED We Stand for

●

CY CALDWELL

● There's one thing more than any other for which we folks in aviation are famous—our lack of unity. We can't seem to get together on anything that affects our welfare. Maybe it's because we are Rugged Individualists.

For example—what is the current aviation thought about the Department of Air, as proposed by Congressman John J. McSwain in H.R. 7041, introduced in the House of Representatives March 27, 1935? The bill was referred to the Committee on Military Affairs—and bills have an unfortunate habit of languishing and finally dying in Committee. It probably is too much to hope that all of us in aviation will get behind this bill and tell our Congressmen that we want it passed. Our standard aviation practice is to forget something important and spend our time quibbling over petty details.

To illustrate: If the politicians, engaged (as I am told politicians sometimes are) in a bit of plain and fancy skullduggery, decide to cancel all the air mail contracts, the Army is happy to leap into the breach to show the politicians how much better it can carry the mail than was done before it arrived on the scene. Then, when the Army comes an ignominious cropper, most of us in aviation give off a derisive laugh and remark vindictively, "We *told* you so!" And when the poor old Army goes out to bomb an abandoned freighter, takes several stabs at trying to locate it and, when it does find it, fails to duck it beneath the waves, as per schedule, the Naval aviators chuckle with delight!

When sweet little 'Gene Vidal tramples with his polished number eights all over the small plane manufacturers and the used plane salesmen, the large plane manufacturers stand strictly aloof and see no necessity for raising their voices in protest. And when an airline gets into trouble through a crash the embattled pilots of the Air Line Pilots' Association pass out promiscuous remarks that are not a bit helpful. The commercial pilot does nothing to aid the sportsman pilot, considering him a mere social butterfly, and the sportsman pilot isolates himself like Byrd in the Antarctic, disdaining to mingle with the common commercial herd. The poor neglected Reserve Officer hoofs it out to Mitchel Field for his tour of duty, finds only a single solitary airplane for some twenty pilots to fly—and the Army Air Corps laughs at his plight in a most obnoxious manner. Meanwhile the lordly Naval aviator peers down disdainfully on the whole lot, and thanks Poppa Neptune that he is not as other men.

What's the matter with us, anyhow? Aren't we all in aviation, able to progress only as aviation as a whole progresses? Are we as individuals so lacking in understanding that we cannot see that the hard luck of some of us is the hard luck of all? Isn't it about time that everyone in aviation joined with everyone else in aviation and stood solidly behind some ONE thing on which all of us should be able to agree? Can we manage to agree that a Department of Air is what most of us need? And if we agree, can't we throw our collective weight behind the McSwain bill in an effort to achieve this desirable forward step? And even if this bill fails of passage in the next session of Congress, is it too much to hope that the ideas back of this bill will not be permitted to die, but will be carried on.

A Bill to Promote National Defense

Of course, it may not be possible to get all of aviation's self-seeking prima donnas behind one single thing that should work out to the advantage of aviation, for I am afraid that the majority of us, being only human, think more about ourselves and our own little problems than we do about aviation as a whole. We're a short-sighted and intensely individualistic aggregation. The Army pilot thinks he's Army; the Navy pilot thinks he's Navy; the commercial pilot thinks he's commercial—and that commercial aviation is the only thing that really matters; the sportsman pilot hopes that he's society; and few in these groups are giving any thought to aviation as a whole, of which his particular division is merely a part. It is time to think about aviation, for at present it is in a thoroughly unsatisfactory position in our national affairs; and most of us are simply moving around in our own little orbit, making as much progress as goldfish in a bowl.

H.R. 7041 is a bill to promote national defense by creating a Department of Air and a Secretary of Air who will have the same standing as the Secretaries of War, Navy, and Commerce. It shall be the province and duty of the Department of Air to foster, develop, and promote all matters pertaining to aeronautics, and to perform all aeronautical duties heretofore assigned to the War Department, Department of Commerce, National Advisory Committee of Aeronautics, and the Weather Bureau of the Department of Agriculture. The bill provides for transfer without loss of rank of the officers of the Army, Navy, Marine Corps, and Coast Guard to the United States Air Force. It provides also for an Air Reserve and a Junior Air Reserve. In short, the Department of Air will include all aviation except that of the United States Navy.

And that exception is, I believe, a very wise one. Setting aside from this discussion the obvious difficulty of achieving harmony between Army and Navy officers

In case of war, the Army at Governor's Island would have to get itself a rowboat and paddle ashore before it could do anything

Anything!

thrown together in one force—which has been and still is a problem in the air forces of all foreign countries—considerable thought about the matter and some discussion with well-informed people has convinced me that the control of Naval Aviation belongs rightly in just one place—the Navy, without any interference whatever from other airmen whose flying has been done largely over land.

In the first place, it must be recognized that Naval Aviation, as presently constituted, is not a sea air force; it is an auxiliary arm of the Navy. It is just as much a part of the fleet afloat as a flotilla of destroyers or a section of battleships. As such, it is entirely dependent upon the surface Navy for its sea bases, such as the carriers and other naval vessels; and those vessels could not exist in war-time independently of the Fleet of which they form a part. To divide the Navy from its aviation would be to set up two independent commands working on or above the same medium, and working from and with the vessels of the Fleet.

In the second place, Naval Aviation has been planned to assist the surface Navy, which would be blind and helpless without it. While it is true that in some Naval minds the aviation units are regarded merely as an air flotilla, I do not believe that this conception is held today by the majority of Naval officers.

An understanding of aviation as it affects the Navy is present in the mind of every Naval officer even if they won't admit it. And every officer is fully cognicent of the necessity of aviation working with the fleet and being an integral part of the fleet. Every ship which has room enough to carry an airplane has one or more aboard.

Leave Naval Aviation As It Is

Unlike the Army, which knows practically nothing about its own Air Corps or its G.H.Q. Air Force, the Navy *lives* with its aviation every day in the year. Or rather, Naval Aviation lives with the Navy. The officer in the airplane and the officer on the deck of the ship below understand each other; they have had the same basic training and they speak the same language; and in many cases they are one and the same man—the airman is a seaman and the seaman is also an airman. Taking everything into consideration, therefore, it seems excellent sense to leave Naval Aviation precisely where it is, free to act in the way that may be deemed to be of most service to the Navy.

While this brief summation may appear to conflict with articles I wrote some years ago on the battleship-airplane controversy, actually there is no conflict in my mind. I still am of the opinion that navies of the future will tend more and more to work in the air and under the water, for I believe that air power is going to force the surface battleship to transform itself into a submarine. But that time still is distant; and in the present state of all the world's navies I feel that it is useless to do more than speculate about such a radical change. It undoubtedly will be a very gradual change, a process of evolution extending over years. It will be hastened, no doubt, by the expansion of land-based Air Forces, whose radius of action will take them over the seas and bring them into conflict with surface navies and the auxiliary aviation of those navies. Technical advancements of aircraft eventually may render all navies such as we know today obsolete as to surface equipment, in which event the Navy officer will take to the air and leave his boat behind—he is quite at home in either craft. That, however, is all in the future. All practical considerations of the present point to the desirability of leaving Naval Aviation in sole command of the Navy.

The Army's Illegitimate Son

The partially earthbound Air Corps and the G.H.Q. Air Force of the United States Army is, on the contrary, an entirely different matter. Here we have no cohesion between the air forces and the land forces; they are, to all intents and purposes, entirely separate and distinct services, mutually distrustful and jealous of each other. Not only is there no understanding between the land and air services; there is actual dislike. The Army does not understand or appreciate its own Air Corps, and views it with mingled feelings of suspicion and dread. It is almost as much of a menace to the Army ground mind as are the hypothetical bombers of an enemy air force.

The Air Corps officer, on the other hand, is trained by the Air Corps to cooperate with the ground Army and to have much understanding of the Army's problems. He is instructed by lectures not only to learn something about Army tactics, but also to comprehend that mysterious element of warfare known as strategy. It may be said that tactics includes the disposition of all forces in contact with the enemy, while strategy includes the disposition of forces not in contact with the enemy. It is these forces not in contact with opposing ground forces with which the Air Corps officer alone may deal. With his observation and photographic machines he may discover what disposition the enemy is making of forces far behind the lines, and thus supply vital information far in advance of an attack. To do this intelligently, of course, he must understand how forces are moved about, learn to interpret troop movements in terms of increased rail and road transport activity, and generally keep the ground army informed of enemy movements about which they otherwise could know little, except by the uncertain medium of spies behind the enemy's lines.

The Air Corps officer, with his bombardment planes, can do a very great deal to hamper the movement of troops and supplies back of the lines, and with his attack planes to disorganize and partially destroy forces on the move. He also, of course, must observe for the artillery; and to do that helpfully he must know something about artillery. In short, in order to do his job at all the Air Corps officer must know a great deal about the organization of ground armies and the strategy that directs those armies; and the Air Corps has studied these very things. In doing so, however, the Air Corps has had no real co-operation from the Army, and thus the air officer feels that his work is neither understood nor appreciated by the Army. Hence he tends to grow ever more impatient with a ground service which he considers hide-bound in its traditions and in its thinking. He loses respect for the senior line officers under whose direction the Air Corps and the G.H.Q. Air Force is muddling along.

The truth seems to be that the Air Corps is regarded as the illegitimate son of the Army, rapidly growing up to plague its erring and backward parent. The sooner the lad takes off on his own, the better it will be for all concerned, including the patient taxpayer, whose defense in war-time, under these conditions, is a subject more for speculation than for satisfied rejoicing.

Don't Expect the Impossible

It is a fact that armies the world over are commanded by elderly gentlemen whose life work it has been to move slowly about on land, and not to depart from it in anything less stable than an elevator. These elderly officers, who have spent years in the study of land warfare, and many of whom are highly intelligent, are eminently fitted by training and experience to direct the movements of our land forces; and so long as they confine their directorial efforts to matters that come within their experience, their opinions merit respect. It is when they presume to control the movements of a new force in warfare, operating in a medium about which they know practically nothing that their capabilities for the job must be questioned.

To expect these senior officers, whose lives and whose thoughts have been entirely on the ground, to embrace aviation enthusiastically is to expect the impossible. They cannot do it. Any random thoughts they may have about Air Power are strictly academic; from personal experience they know nothing about it.

(*Continued on page* 68)

EDITORIALS

> "The achievements in aviation are taken for granted just as our fathers took the railroads and the telephone for granted in their day. I believe that the first half of the twentieth century will be known chiefly for man's conquest of the forces of nature, making possible almost instantaneous communication into all parts of the world and swift transportation to the extent that we may truthfully claim conquest over distances."
>
> —MAJOR JAMES H. DOOLITTLE, Aviation Manager, Shell Petroleum Corp.

Give Pilots a Square Deal

● The National Air Races this year furnished the scene for an incident which shows how far these events are from dealing intelligently with the pilots who make the races possible. Under the rules of the Thompson Trophy Race, a contestant *must have established a qualifying speed of 225 m.p.h. or better in order to be eligible.* (The italics are ours, and the words are taken verbatim from the official schedule of events.) In placing second to Benny Howard in the Bendix Race from Los Angeles to Cleveland, Roscoe Turner averaged (according to the official results of the race) 238.522 m.p.h., so that at times he undoubtedly reached speeds much higher than his average. Yet, on the morning of the Thompson Race, the N.A.A. officials compelled him to run his qualifying tests, and then when they were satisfied his speed in the Bendix was not done with television, qualified him and then asked that he sign waivers for some of the other contestants, which he did. The qualifying tests took just enough out of his engine to cause his withdrawal as he entered the last lap of the race, after leading the field by a wide margin.

This obvious lack of intelligence not only cost Turner first place money in the Thompson ($6750), but also indicates generally the type of treatment pilots are getting from the N.A.A. officials who also bungled the report of the race in *Skylights,* an official N.A.A. publication, by saying that "Harold Neumann won the Thompson Trophy by out-distancing Roscoe Turner, a close second." Turner never was in second place and had a comfortable lead at all times until he was forced out.

It is time paid officials, who know little about racing, ceased meddling into the affairs of engineers and pilots who spend years developing their designs to further the advancement of aeronautics.

Thank Heaven!

● Jim Farley will probably not be Postmaster General after next January. Farley will be remembered for the great aviation tragedy—the sudden and unwarranted cancellation of the air mail contracts. He will go down in history as the man who instituted a new procedure in American jurisprudence—trial without arraignment; and he will be pointed out as the person who knew less about our problems than any other of his predecessors. Let us hope President Roosevelt will appoint as Postmaster General a man who is familiar with our transport system, and who has at least a faint idea of its problems. As long as the law provides a Postmaster General with power to grant all mail-carrying contracts and to supervise air mail activities, just so long is it imperative that we have someone on the job who knows what it's all about.

Farley came closer to wrecking the air mail system than most people realize or care to admit. Our next Postmaster General may make some amends for the folly of Farley. Whether he does so remains to be seen, but he undoubtedly will be a lot less ambitious soul than the present incumbent who attempted to balance the budget by killing off a lot of Air Corps pilots and by making a wretched failure of trying to override the established and fundamental laws of our country.

As a farewell message Mr. Farley, the aviation industry will not be sorry to see you go. If you conduct the presidential campaign as you did the Post Office Department, a Republican will be in the White House in 1937.

A Tribute To Our Engineers

● The deal that licensed a British aircraft manufacturer to produce Sikorsky S-42 flying boats in England is a distinct tribute to American aeronautical engineers. It is a frank admission that this country is far ahead of other nations in the development of marine aircraft, and that unless England is to become out-distanced in the race for supremacy of the world's aerial trade routes, she must avail herself of our aid.

Anti-American aircraft propaganda abroad has been checkmated sufficiently to have influenced purchasers who desire the finest in aerial transport. The large number of Douglas sales made in Europe is excellent evidence of how we stand in the eyes of those who want safe, dependable, comfortable and speedy transportation over land routes. Now that the S-42 is to be manufactured abroad, the same kind of transportation will be available to foreigners who fly over water routes.

An Appreciation of American Aviation

● In our every-day contact with things aeronautical in this country we sometimes take for granted what has been accomplished. It is only when we listen to foreign aviation officials here on a tour, that we fully realize how much further advanced in aviation we are than other countries.

Those dignitaries from Latin American countries and Canada who were in the United States to help us observe Air Navigation Week, returned to their homes with nothing but the highest praise for what we have to offer, for the manner in which they were received and feted, and for our whole-hearted endeavors to help them in their aeronautical problems. They left with the impression that nowhere in the world could they find an industry so far ahead in aeronautical development.

Visits of this nature are inspirational not only because they cement a closer relationship and greater good-will, but also because they are the means of showing the world that America leads in aviation.

Stratosphere Developments

● Aircraft and engine builders have done yeoman work in the development of a successful stratosphere plane. The problems of maintaining both life and engine power at 50,000 feet and more are not insoluble, and the future of aviation undoubtedly lies in that zone of the sky where the tenuous atmosphere can oppose little drag to the progress of the plane.

Optimists believe speeds of 1000 m.p.h. and more may ultimately be realized in the stratosphere. The possibilities of commercial and military operations there are tremendous. Great Britain already is building a stratosphere plane and present expectations are that the new ship will be ready to take the air before the middle of next year.

With the successful flight of this plane, England again will have assumed the lead in another development which we pioneered and then seemed to forget. The stratosphere holds enough promise in lucrative returns in business, commerce, and travel for our designers and engineers to devote greater attention to the development of a craft which can negotiate its as yet unexplored possibilities.

FLIGHT PLAN

●

P. T. W. SCOTT

Pilot, Transcontinental & Western Air, Inc.

The airline pilot, in planning and executing his flight has a particular phase of the problem confronting him—that of making scheduled stops on time, with maximum economy, and in any flyable weather condition. It is desirable to set up the fastest schedule consistent with sound operating policies, but in selling speed, adherence to established schedules is essential.

From time to time, the detailed preparations and careful calculations made for navigation prior to the start of a special long distance flight are described. Often the flight is planned for favorable weather. The start generally is delayed until conditions are suitable, at which time final corrections are made to the already elaborate preliminary calculations. This type of flight planning is not applicable to airline operation, and although a need existed for something more than a quick mental estimate by the pilot, it is only recently that there has been developed an intermediate method—one of adequate accuracy but without the complications involved in a theoretically correct procedure, and one readily used by all flight personnel.

● The equipment used until recently on airlines allowed little flexibility in its cruising characteristics, so that schedules were set up rather loosely and the pilot cruised at the best apparent altitude, easing back a little or pushing it as circumstances indicated, hoping to get in "about schedule."

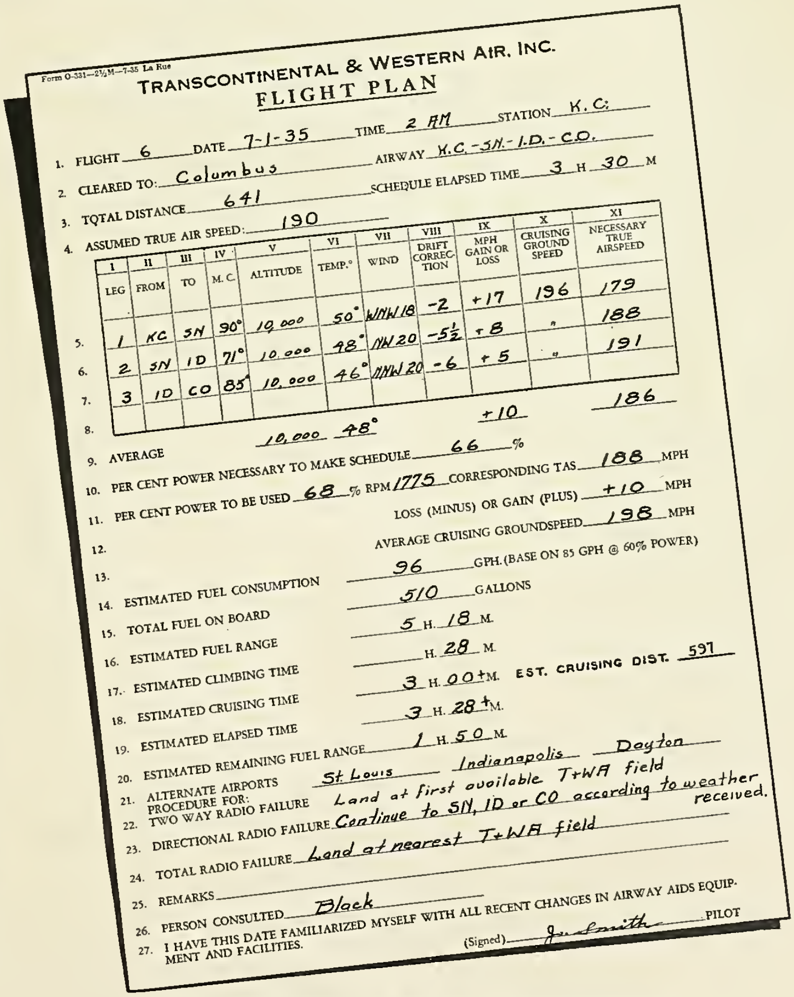
With the advanced type of equipment now in use, there is a greater range of speed and altitude, plus more accurate guidance to the power being used, and the airspeed being made. Longer non-stop flights are now undertaken, and considerations must be given to operations with the equipment of the not-too-distant future, which will have a greater cruising range. The present knowledge of weather conditions, and more accurate data available on winds aloft, is another aid to careful flight planning.

In order to take advantage of their advanced type of equipment, and to improve the effectiveness of their operations, TWA maintains a navigation engineering department. Peter Redpath, chief of the department, has developed a standardized procedure by which pilots make out a flight plan to precompute their flights prior to take-off. A completed flight plan is shown in figure 1. This form is completely filled out, in duplicate, by the pilot prior to the flight, the original being carried by him, and the copy being filed in the dispatch office for the information of the supervisory personnel. The blanks, in pads, are alternately pink for the original and pale blue for the carbon copy duplicate. The illustration shows the form now in use. From time to time changes will be made as suggested by experience.

The crew, as has been the company policy, arrives an hour before their departure to study weather conditions along the route. If these conditions are found suitable, the next problem is to determine the most desirable cruising altitudes with accompanying winds and temperatures aloft. This is generally done with the aid of the meteorologist on duty.

In past years, it was a common complaint that wind aloft observations were only available in good weather. During inclement weather, when they were needed most, they were unobtainable. TWA's meteorologists are using the air mass method of forecasting, which, as the name implies, is based on the study of the movement of air masses. It is essential that the meteorologists have a clear conception at all times of the winds and temperatures aloft. When the weather is at its worst, the meteorologist studying these phenomena as they continuously progress across the country, has his best indications, second only to actual balloon-run test information, regarding the movements of the air aloft. There are flights in the air at all times, and reports from these and previous flights help considerably in a determination of what the following flights may expect.

In choosing the most desirable cruising altitude, particular attention is given to the winds aloft, but many other factors must be taken into consideration. In case



Form O-331—2½M—7-35 La Rue

TRANSCONTINENTAL & WESTERN AIR, INC.

FLIGHT PLAN

TIME 2 AM STATION K. C.

1. FLIGHT 6 DATE 7-1-35 AIRWAY K.C.-SN.-I.D.-C.O.
2. CLEARED TO: Columbus SCHEDULE ELAPSED TIME 3 H 30 M
3. TOTAL DISTANCE 641
4. ASSUMED TRUE AIR SPEED: 190

	I LEG	II FROM	III TO	IV M. C.	V ALTITUDE	VI TEMP.°	VII WIND	VIII DRIFT CORRECTION	IX MPH GAIN OR LOSS	X CRUISING GROUND SPEED	XI NECESSARY TRUE AIRSPEED
5.	1	KC	SN	90°	10,000	50°	WNW 18	-2	+17	196	179
6.	2	SN	ID	71°	10,000	48°	NW 20	-5½	+8	"	188
7.	3	ID	CO	85°	10,000	46°	NNW 20	-6	+5	"	191
8.											
9. AVERAGE					10,000	48°			+10		186

10. PER CENT POWER NECESSARY TO MAKE SCHEDULE 66 %
11. PER CENT POWER TO BE USED 68 % RPM 1775 CORRESPONDING TAS 188 MPH
12. LOSS (MINUS) OR GAIN (PLUS) +10 MPH
13. AVERAGE CRUISING GROUNDSPEED 198 MPH
14. ESTIMATED FUEL CONSUMPTION 96 GPH. (BASE ON 85 GPH @ 60% POWER)
15. TOTAL FUEL ON BOARD 510 GALLONS
16. ESTIMATED FUEL RANGE 5 H. 18 M.
17. ESTIMATED CLIMBING TIME H. 28 M.
18. ESTIMATED CRUISING TIME 3 H. 00+ M. EST. CRUISING DIST. 597
19. ESTIMATED ELAPSED TIME 3 H. 28+ M.
20. ESTIMATED REMAINING FUEL RANGE 1 H. 50 M.
21. ALTERNATE AIRPORTS St. Louis Indianapolis Dayton
22. PROCEDURE FOR: TWO WAY RADIO FAILURE Land at first available T+WA field
23. DIRECTIONAL RADIO FAILURE Continue to SN, ID or CO according to weather received.
24. TOTAL RADIO FAILURE Land at nearest T+WA field
25. REMARKS
26. PERSON CONSULTED Black
27. I HAVE THIS DATE FAMILIARIZED MYSELF WITH ALL RECENT CHANGES IN AIRWAY AIDS EQUIPMENT AND FACILITIES. (Signed) J. Smith PILOT

Figure 1. Flight plan form as filled out for a scheduled flight

of the Douglas DC 2, it can be seen from its cruising chart (figure 2), that the same percentage of power gives increased speeds with increased altitudes. In addition, something less than maximum cruising power of 75% must be used when cruising at less than 8500 ft. density altitude, for below this level manifold pressure, rather than percent power, is the limiting factor (this cruising chart was described in detail in the September, 1935 issue of AERO DIGEST). Thus it is sometimes advisable to fly at high levels, even though winds there may be slightly less favorable than those at lower altitudes.

Effect of Lengthy Climb

The length of the flight is important, for often the effect of slower speed during a lengthy climb to a high altitude cannot be overcome by the increased speed during a shortened cruising period. Table I shows this clearly. These tables are available for all scheduled flights, and give the cruising ground speed necessary to make schedules when cruising at various altitudes. In computing this table, the total time (scheduled time) is divided into climbing time and cruising time. The total time is block-to-block, so the average total taxiing time, 7 minutes, is allowed and is included in the climbing time. The time assumed for the actual climb from the altitude of the airport to the cruising altitude and the distance traveled during the climb are based on passenger comfort limitations, normal performance, and still air. The remaining distance and the remaining time are shown as cruising distance and cruising time, respectively, and the former, divided by the latter, is taken as the cruising ground speed. The descent is included in the cruising period, for experience with this equipment has shown that by careful choosing, the rate of descent, gradual when winds are favorable in the lower levels, and rapid when unfavorable winds are encountered, will be made at an average speed equal to or slightly greater than the cruising speed. These approximations work out well in practice, for this equipment, and attempts to take into account every variable would cause needless complications.

In short flights, such as from Kansas City to St. Louis, a distance of 229 miles, if an altitude of 4000 ft. is chosen, the necessary cruising ground speed is 182.5 m.p.h. which must be maintained for 1 hour 12 minutes to make the trip in the scheduled 85 minutes. If the trip is made at 12,000 ft., only 51 minutes would be available for cruising, and the cruising ground speed would be necessarily 199 m.p.h. to make the same scheduled time. For no wind condition, if at 4,000 ft. we assume a temperature of 70°, 70% power would be necessary whereas at 12,000 ft. and assuming 40°, 75% power would be required. Thus for short flights, cruising at high altitudes is desirable only when the winds are particularly favorable, or when unfavorable conditions force the pilot "up there."

On the 641-mile flight from Kansas City to Columbus, flying at 12,000 ft. instead of 6,000 ft., means an increase of only 3 m.p.h. in the necessary cruising ground speed, since the climbing time is not as large a percentage of the total time. At 6,000 ft., assuming temperature 65°, 78% power would be necessary. At 12,000 ft. and 40° temperature, 72.5% power would be necessary. Thus for a no wind condition, it would be more economical to fly at a high altitude on a flight of this distance.

While these cruising speeds may appear high for this equipment, it must be remembered that schedules are set up on a basis of 65% power, and on the prevailing winds.

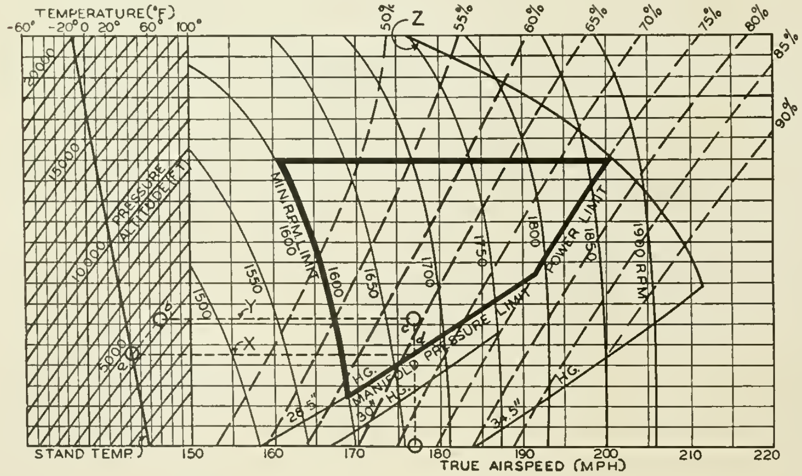
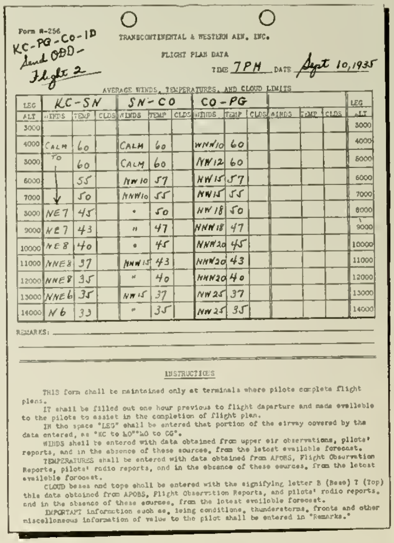


Figure 2. Cruising chart for the Douglas DC-2 transport



Form #-256

KC-PG-CO-1D
Send OBD-
Flight 2

TRANSCONTINENTAL & WESTERN AIR, INC.

FLIGHT PLAN DATA

TIME 7 PM DATE Sept 10, 1935

AVERAGE WINDS, TEMPERATURES, AND CLOUD LIMITS

LEG	KC-SN			SN-CO			CO-PG						LEG
ALT	WINDS	TEMP	CLDS	WINDS	TEMP	CLDS	WINDS	TEMP	CLDS	WINDS	TEMP	CLDS	ALT
3000													3000
4000	CALM	60		CALM	60		WNW10	60					4000
5000	TO	60		CALM	60		NW12	60					5000
6000		55		NW10	57		NW15	57					6000
7000	↓	50		NNW10	55		NW15	55					7000
8000	NE7	45		"	50		NW18	50					8000
9000	NE7	43		"	47		NNW18	47					9000
10000	NE8	40		"	45		NNW20	45					10000
11000	NNE8	37		NNW15	43		NNW20	43					11000
12000	NNE8	35		"	40		NNW20	40					12000
13000	NNE6	35		NW15	37		NW25	37					13000
14000	N6	33		"	35		NW25	35					14000

REMARKS:

INSTRUCTIONS

THIS form shall be maintained only at terminals where pilots complete flight plans.

IT shall be filled out one hour previous to flight departure and made available to the pilots to assist in the completion of flight plan.

IN the space "LEG" shall be entered that portion of the airway covered by the data entered, as "KC to LO""LO to CG".

WINDS shall be entered with data obtained from upper air observations, pilots' reports, and in the absence of these sources, from the latest available forecast.

TEMPERATURES shall be entered with data obtained from APOBS, Flight Observation Reports, pilots' radio reports, and in the absence of these sources, from the latest available forecast.

CLOUD bases and tops shall be entered with the signifying letter B (Base) T (Top) this data obtained from APOBS, Flight Observation Reports, and pilots' radio reports, and in the absence of these sources, from the latest available forecast.

IMPORTANT information such as, icing conditions, thunderstorms, fronts and other miscellaneous information of value to the pilot shall be entered in "Remarks."

Figure 3. Typical flight plan data furnished the pilot by the meteorologist

Height of the terrain obviously is taken into account. One definite requirement for safety is that all east-bound flights must fly at even thousand foot altitudes, and all west-bound at the odd thousand foot levels. Consideration must also be given to general weather conditions, and levels at which serious icing is apt to occur must be avoided. At times a statically charged layer of clouds that would block out radio reception will be the deciding factor. When moderate to severe thunderstorms are reported it is usual to pick a level free of general cloudiness so that the thunderstorms may be observed and circumnavigated if necessary. When a front or wind shift is encountered, its nature and severity is often the basis for choosing the cruising altitude in that area.

Passenger Comfort

Passenger comfort always must be considered. Often an uneconomically high level is chosen in order that the customers may better enjoy their trip, above heat, above dust, or above bumpy air. Passengers, particularly during daylight, prefer flying at a level where they can see things and this sometimes keeps a pilot from a level where, by flying on instruments, he would get the most advantageous winds. As a general rule, considerations of passenger comfort are factors which tend to increase the cruising altitudes. In the old equipment which had inadequate heaters, the cabin temperature was often a limiting factor during cold weather, but now this is no longer an item. One of the most definite limits, that of not going over 14,000 ft. under normal conditions, is a consideration of passenger comfort. The heavy black line on figure 2 marking the top limit of the cruising area is based on the physical comfort of the passengers and not on the capabilities of airplanes.

All this may seem complicated, but actually only a few of the many factors need be taken into account for any one flight, and a decision can be quickly made on the basis of past experience. Once the most desirable cruising altitudes, their accompanying winds and temperatures aloft have been determined, the necessary information is at hand to complete the flight plan.

For example, we will take the case of Flight 6 from Kansas City to Columbus, Ohio. On the flight plan (figure 1) lines number 1 and 2 label the flight. Line 3 can be filled in from the time table or from figure 3. The assumed true airspeed of line 4 is not critical, being used only in working the wind triangle problems to determine drift and gain or loss in speed. It is recorded so that others may check the results. If ground speed and drift tables are used in preference to a calculator, the pilot indicates drift tables used on this line.

Tables for Specific Courses

These ground speed and drift tables (Table II) are available for all courses normally used by TWA. Being made out for the specific courses and normal cruising speeds only, they are handier than speed drift tables for universal use. For values of wind forces falling below or between tabulated values, the resulting drift corrections and gain or loss in speed is obtained by interpolating. Since aircraft calculators are necessary for some of the work, they are carried by all of the flying personnel, and their use is rapidly supplanting the drift tables.

In making out a flight plan for short flights, only one line of the table (lines 5 to 8) is used, but when the course, altitude, temperature, or wind varies, the trip is broken up into several legs of approximately equal length, and columns I, II, III and IV are filled out as shown. The previously determined altitude, temperature and wind is entered in columns V, VI, and VII. The drift correction, and the gain or loss in speed is computed for each leg, using an aircraft calculator or drift tables, and entered in columns VIII and IX respectively. The data for column X is taken from Table I. It is always considerably greater than the block-to-block cruising speed. Being an average for the specific flight, it is the same for all legs. The necessary true airspeed is determined by subtracting or adding the gain or loss respectively of column IX and X.

When, as in this example, it is necessary to compute the flight in more than one leg, the averages are filled in on line 9. While the use of this average is not theoretically correct, it is practically so as long as the legs are of about equal length.

Using the values, or averaged values, of columns V, VI and XI, the percent power necessary (line 10) is obtained from figure 2. When this power necessary falls within a normal range, the pilot generally adds 1 or 2 percent to cover contingencies, and enters it on line 11. When this is not within the cruising limits of the equipment, the nearest usable power is entered. The corresponding r.p.m. and true airspeed is determined from the cruising chart, at the same time. The average gain or loss of column IX is entered on line 12, and this applied to the corresponding true airspeed gives the average cruising ground speed, line 13. The estimated climbing time (line 17) and the estimated distance to cruise (line 18) are available in Table I.

Dividing the estimated distance to cruise by the average cruising ground speed gives the information for line 18, and this, added to the estimated climbing time, line 17 (which includes all taxiing time), gives the estimated elapsed time (block-to-block), for the flight.

Fuel consumption is directly dependent on the percent power used, and this, based on experience, is filled in on line 14. This figure is then divided into the total fuel on board (line 15) to get the estimated fuel range, line 16. Subtracting the estimated elapsed time for the flight from the estimated fuel range gives the estimated remaining fuel range for line 20. This must be ample to cover all contingencies plus the 45-minute margin of safety required by the Department of Commerce. Being thus shown, its adequacy is immediately apparent to both flight and supervisory personnel.

The alternate airports shown on line 21, are the best apparent "outs" in the event that the weather closes in at the destination. One field is necessary to comply with the Air Commerce regulations (Bulletin 7-E) which requires that there must be an airport or intermediate field equipped with radio beacon, within the fuel range of the airplane, exclusive of the reserve fuel supply (45 minutes) other than the point of intended landing, which has a steady or improving ceiling of not less than 1500 ft. and a visibility of not less than 2 miles. Two or more fields are selected and shown on the form.

Before discussing the procedure to be shown on lines 22 to 24 inclusive, a brief description of the radio equipment is necessary. TWA's two-way equipment consists of a complete receiver and a transmitter, each crystal-controlled for fixed tuning, with a selection system to quickly choose any one of the four company frequencies. A trailing wire antennae is used. The main beacon receiver (using a fin antennae) tunes in the entire range of beacon frequencies. In common with the two-way equipment, it uses a power unit with the plane's battery as the source of supply. The third receiver, smaller and of shorter range than the above, is known as the auxiliary receiver. While normally operated from the storage battery, it may be operated from its own auxiliary dry cell supply in which case it is independent of other equipment, as it also uses its own "belly antennae." This set will tune in all beacon stations, and in addition, two of the four company frequencies—both two-way, night frequencies.

Radio Equipment Tested

The operation of all radio equipment is tested by the pilot, and must be in perfect order prior to the start of the flight.

Complete failure of the two-way equipment would still permit reception on the two night frequencies through the auxiliary receiver, or messages could be broadcast to the pilot from nearby radio beacons. Likewise, in the event of directional radio failure, or total radio failure,

(*Continued on page 70*)

Table I: (below) Cruising ground speed necessary to make schedules

Table II: (right) Ground speed and drift tables

FLIGHT NUMBER	STANDARD PRESSURE ALTITUDE	TOTAL DISTANCE	CLIMBING DISTANCE	CRUISING DISTANCE	TOTAL TIME	CLIMBING TIME	CRUISING TIME	CRUISING GROUND SPEED
2 & 4	4000	229	10	219	1:25	13	1:12	182.5
Kansas City	6000	229	17	212	1:25	17	1:08	187
-	8000	229	28	201	1:25	22	1:03	191.5
St. Louis	10000	229	44	185	1:25	28	:57	194.5
	12000	229	60	169	1:25	34	:51	199

KC-SN T.C. 96½° - 7° E = M.C. 89½°

6 - 8	6000	641	17	624	3:30	17	3:13	194
Kansas City	8000	641	28	613	3:30	22	3:08	195
-	10000	641	44	597	3:30	28	3:02	196
Columbus	12000	641	60	581	3:30	34	2:56	197

KC-SN 97° (Eastbound) (Westbound) SN-KC 277°

	10-Mi Wind		15-Mi Wind		20-Mi Wind		25-Mi Wind		30-Mi Wind		40-Mi Wind		
Wind Direction	Wind Corr Deg.	Gain or Loss MPH	Wind Corr Deg.	Gain or Loss MPH	Wind Corr Deg.	Gain or Loss MPH	Wind Corr Deg.	Gain or Loss MPH	Wind Corr Deg.	Gain or Loss MPH	Wind Corr Deg.	Gain or Loss MPH	Wind Direction
N	-3	2	-5	2	-6	3	-8	3	-9	2	-13	2	S
NNE	-3	-3	-5	-5	-6	-6	-8	-8	-9	-11	-13	-15	SSW
NE	-2	-7	-4	-10	-5	-13	-5	-17	-7	-21	-10	-28	SW
ENE	-2	-9	-2	-13	-3	-17	-4	-22	-5	-27	-6	-36	WSW
E	-1	-10	-1	-15	-1	-20	-1	-25	-1	-30	-1	-40	W
ESE	1	-10	2	-14	2	-18	2	-24	3	-29	4	-38	WNW
SE	2	-8	3	-2	4	-16	5	-20	6	-24	8	-33	NW
SSE	3	-5	4	-8	6	-11	7	-14	8	-17	11	-24	NNW
S	3	-2	6	-2	6	-3	8	-4	9	-5	13	-9	N
SSW	3	3	5	-4	6	-5	8	4	9	5	13	6	NNE
SW	2	8	4	9	5	12	6	15	7	18	10	23	NE
WSW	2	9	2	13	3	17	4	21	5	25	6	34	ENE
W	1	10	1	15	1	20	1	25	1	29	1	39	E
WNW	-1	10	-2	14	-2	18	-2	24	-3	28	-3	38	ESE
NW	-2	8	-3	11	-4	15	-5	18	-6	22	-8	29	SE
NNW	-3	5	-4	7	-6	9	-7	11	-8	13	-11	17	SSE

FUELING SYSTEMS FOR AIRPORTS

● During aviation's early days the hand-operated piston-type pump, similar to those commonly seen at automobile filling stations, was used at airports for fueling purposes. The practice was to install the pump near a hangar where it would be out of the way and then run an underground discharge pipe out onto the field to a box where a hose was coiled.

As the need for faster dispensation of gasoline became urgent at flying fields, the old pump became inadequate to cope with the growing situation, and manufacturers turned their attention to the development of fueling systems especially adapted for use at airports and flying fields.

Their problem was primarily the rapid delivery of clean gasoline, but they also had to contend with servicing and storage conditions. From their efforts was evolved the present-day underground pits which feature reliability, safety, speedy delivery, and quick and easy operation, these outlets being so located and of sufficient capacity to meet all normal conditions, and can be placed to give maximum service with minimum ship movement.

Among the first designs was a complete airport fueling system, based on the principle of a self-contained service pit. This was installed in the field with the top flush with the ground level, a pumping unit for installation in a special pump-house or hangar, and an underground storage tank of the capacity required. Since this type was produced, the equipment has undergone modifications and improvements so that today a complete line of airport fueling equipment is available, suitable for the smallest out of the way emergency field, where a comparatively slow speed delivery will suffice, to the busiest airport requiring fast delivery speeds. These systems are suitable for seaplane terminals as well as land airports, and in addition, fueling equipment for a complete self-contained fueling barge, has also been designed for seaplane service.

Until recently, the largest standard fueling systems were capable of delivering about 35 g.p.m., insufficient to fuel the new large planes in the time necessary to maintain schedules. Now systems capable of delivering 100 g.p.m. have been developed and will be installed at each of the six bases of Pan American's Trans-pacific route which must be provided with high-speed systems; this type is already in use at Pan American's bases at San Juan, Mexico City, Port-of-Spain and Kingston.

In the Bowser fuel system (figure 1), a float suction is used inside the tank to prevent the pump from drawing up accumulated water and foreign matter which precipitates to the tank bottom. This float remains on top of the gasoline so that the fuel drawn into the system comes from the level of gasoline near the surface. On this tank there is also a pump suction for pumping out the water and sediment accumulating in the storage tank bottom.

There is a line check valve from the floating suction, designed to keep the pump primed, and next a pipe line strainer protecting the pump mechanism from foreign matter which might get into the pump.

The pump is belt-driven by a vapor-proof electric motor, although some systems are furnished with a motor-driven pump operated through a reduction gear.

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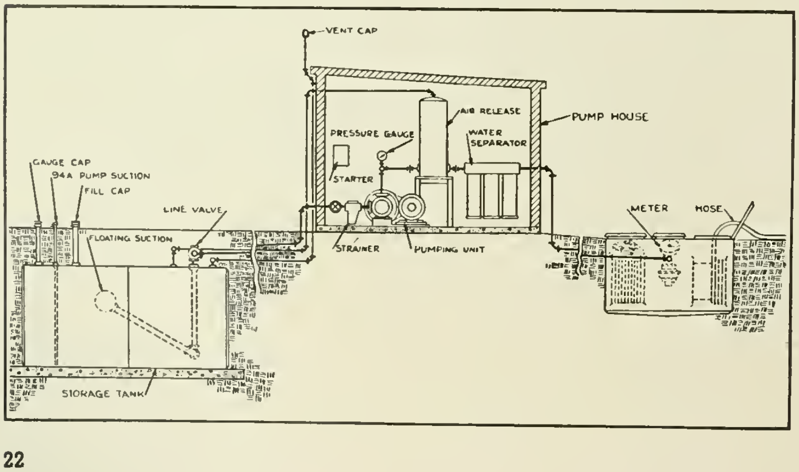
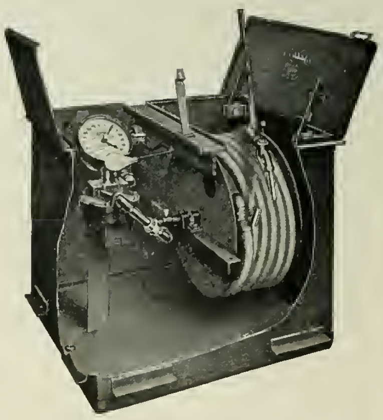
Fig. 1: Diagrammatic sketch of Bowser system





Cut-away view of Bowser fueling pit system for airport use

In cases where electricity is not available, pumps driven by a gasoline engine have been supplied, in which case, the shaft is extended so a firewall can be erected between the engine and the pump.

A pressure gauge is placed in the pump discharge and the next item is an air release serving as a shock absorber and expansion chamber although its primary purpose is to permit any air entrained in the gasoline to separate, thus forcing only a solid, air-free flow of gasoline through piping to the meter in the fueling pit proper.

After the air release the fuel is led to a water separator. For lesser flows, a single-cylinder type is used, a triple-cylinder type being available for high-speed systems. This device operates on the centrifugal principle. As the gasoline is forced through these cylinders, it is caused to whirl rapidly, thus throwing out the heavier particles of water which fall to the bottom of the cylinder where they are drawn off periodically.

From the separator, the discharge line goes underground to the service pit. The distance from the pumping unit to the fueling pit can vary, and in some installations this distance is as great as 1200 ft. However, the distance between the underground tank and the pumping unit is as short as possible, since the shorter the suction line, the more efficient the pumping unit.

The pit shown is the double type adapted for high-speed systems. In the most recent development, there are two hose reels and a meter capable of handling flows up to 110 g.p.m. In the double pit a pressure regulating valve insures that a maximum of 50 g.p.m. will be delivered for each hose whether one is in use, or both.

Pan American Airways uses funnels in fueling their planes and the practice is to put both nozzles into one funnel when it is desired to fill one tank at a speed of 100 g.p.m. Planes equipped with multiple tanks may have two attendants on the wing, each fueling independently with one of the two hoses. Most airplanes are not constructed with fill openings capable of carrying away a high-speed flow by gravity. If these nozzles were directly introduced into the fill hole there would be danger of damaging the tank owing to the discharge velocity of the gasoline coming from the nozzles.

The nozzles, however, are in most cases of the pistol type arranged for controlling the flow to the speed required to fuel a plane without danger or without overflowing a funnel. They also are usually fitted with some type of protective slip cap for the tip so that if thrown on the ground there would be no danger of dirt getting into the nozzle. Inside the nozzle tip a cone screen is usually placed as an additional precaution. The hose can be either of the metal-lined, fabric-covered type, the all-rubber type, or the Duprene-lined rubber type. (Duprene is a synthetic substitute for rubber and is insoluble in gasoline). In the case of the latter two, a spiral static wire is imbedded into the hose walls to add strength and to carry off any static electricity which might be generated. The hose, which can be any length up to 100 ft. and is usually 1½″ diameter, is wound on vertical drums or reels in the pit.

Inside the pit there is a globe valve which permits shutting off the gasoline when necessary, a strainer to protect the meter against foreign matter that might get into the gasoline, the 2″ meter, and in the case of the double systems, a pressure control valve.

In electrically-operated systems, the pit is provided with an electric light over the meter dial and a remote control switch by means of which it is possible to start and stop the pumping unit from the pit in the field. When the pump is running, the light burns and for protection where the pits are installed on landing floats or docks, the light is enclosed in a ship's globe.

The pit is made of 3⁄16″ black steel, welded. The covers are rain-proof and can be padlocked. The top of these land pits is made strong enough to withstand the weight of the heaviest plane taxiing over them. The inside is painted bright red to make it visible from the air, and in the bottom a drain plug is provided so that if water should accumulate, it can be easily drained out. The outside of the pit has anchor clips welded on to keep it from shifting after installation. Connections and hangers are also provided for air and water lines so that these additional services may be installed. A clip is provided on which a fire extinguisher can be mounted.

The *Xacto* meter provides the airplane fueling control. Two types are available, identical except that one has the dial inclined at an angle of 45° to make it more easily visible from a point above. These dials are 10″ in diameter and are mounted on a swivel connection so that they can be revolved 360° to face any direction.

The Gilbert & Barker Aeropit which was described in detail in the October issue of Aero Digest, is built of heavy gauge steel plate, with welded seams and flanged covers. The pit body has an outside coating of coal tar preservative to guard against corrosion, while the interior is finished in aluminum. Coiled around a ball-bearing turntable is a 50-ft. wear-resisting hose equipped with a spring cap fitting over the end of the nozzle. Normal delivery of the pit is 20-30 g.p.m. A displacement type meter is used to record individual deliveries on a dial calibrated from 0 to 100 gal.

In the Aqua Systems (figure 2), water is admitted to the bottom of the storage tank and floats gasoline out of the top, to any number of outlets, at any distance from the storage tank. Each dispensing outlet is equipped with meter, valves, strainer, switch, and a self-closing nozzle is provided at the end of the hose.

The control of the levels to which the gasoline and water can rise or lower within the storage tank is accomplished by valves in the fill and delivery ports or pipes. These valves are operated by differential floats which sink in gasoline but float in water.

As gasoline is withdrawn from the storage tank, new water, entering the bottom of the tank, rises and maintains the supply of gasoline at the top. The operator knows, by reading the stick or direct reading tank gauge, when the gasoline supply is running low. The system is equipped with a safety top shut-off float, which shuts off the valve in the discharge pipe in the event water rises to within six inches of the top of the tank. No fluid can then be drawn from the tank until a new supply of gasoline has been obtained.

To provide against the possibility of overfilling the storage tank, a bottom safety shut-off float is used to take advantage of the difference in specific gravity between gasoline and water. When gasoline reaches a point six inches from the bottom of the tank it automatically shuts off the fill, and no more gasoline can then enter the tank.

As each fueling pit box is provided with an interlocking valve and switch the operating lever must be set before drawing fuel. This switch closes a circuit which opens an electric valve in the water supply to the storage tank so that water may enter the tank as gasoline is withdrawn. The system may be turned off by manual operation or by closing the cover of the pit box which automatically releases the operating lever and shuts off the water supply. Water power to propel the fuel is only consumed when the self-closing nozzle at the end of the hose is opened, and the ship is being fueled.

In systems where more than one tank is used they are manifolded with controlling valves so they may be filled from a common fill line, water supplied from the same water control unit and gasoline may be fed to the fueling pits through a single pipe from any of the storage units.

Although the float-operated valves within the tanks are designed to shut off the valves and prevent operation of the system in the event of failure of the floats, as an added precaution a water trap is provided. This trap is located in the delivery line adjacent to the tanks and employs a differential float-operated valve. This valve is always open but should any water enter the trap the float will be raised and shut off the flow of liquid before water can enter the delivery line, remaining locked until the water is removed. It is then manually reset in the open position.

In pits designed for use with seaplane fueling systems, the weight factor is important and 3⁄16″ steel pits are usually too heavy for installation in the deck of a landing float. Consequently, for this type of installation, there are pits of lighter gauge steel and instead of the reel, the center of the pit is provided with a cone member, around which the hose is coiled by hand. The meter and electrical fittings are placed in a separate pit.

One hose pit and the meter pit constitute a 50 g.p.m. or medium-speed Bowser system. If it is desired to convert this into a high-speed system, an extra hose pit is added. As the meter pit contains the flow control valve, it is thus possible to have a total of 100 g.p.m. delivered. When making the conversion from a medium-speed to a high-speed system it is necessary to have a pumping unit which can deliver that quantity.

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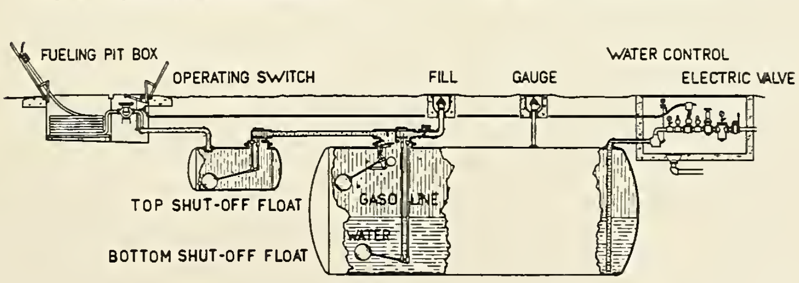
Fig. 2: Aqua fuel system installation



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Take-off Performance of Flying Boats

●

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● Take-off performance of flying boats depends on basic design features, which can be divided into four groups. These are in their effects inter-related in a somewhat complicated manner.

The design of the hull as to size and lines determines resistance in the water during take-off at a given load. The lift produced at various speeds by the wings determines the load on the water at each speed, and has, therefore, large influence on the water resistance of the hull. The speed at which all of the gross weight is lifted by the wings is the get-away speed.

Outside of speed, wing lift depends on the following design features: (1) wing loading per unit area; (2) wing airfoil section; (3) angle of setting of the wing on the hull; (4) trim angle of the hull during the take-off run; (5) wing aspect ratio; (6) distance of the wing from the water surface; and (7) use of flaps or slots as auxiliary lift increase devices.

Modern flying boats have wings usually arranged with angles of setting of wing chord line from 2° to 4° positive to the keel base line. The trim angle of the hull keel base line is usually about 9° at the speed where the hull begins to plane on the main step (usually called the hump speed because the water drag is maximum at that speed). The hump speed of modern flying boats is 25-30 m.p.h., 27 m.p.h. being a good average, and at that speed the wing has, therefore, an angle of attack of 11° to 13°. In excess of the above speeds, the angle of trim of the hull must be kept usually between 5° and 7° and the angle of attack of the wing is then between 7° and 11° which is considerably lower than the angle of maximum lift of modern airfoils.

Two take-off techniques are possible—one to keep the boat on the water until the speed is reached at which the wing at the low angle of attack generates sufficient lift to support the gross weight of the plane; and the other of pulling the plane off at or slightly above the stalling speed, i.e., suddenly increasing the wing angle of attack by pulling on the elevator control, thereby suddenly increasing the wing lift and permitting the get-away. Usually a compromise between these two methods is used, and the plane's get-away speed is somewhat higher than its stalling speed. The distance of the wing from the water influences the lift produced by the wing—a phenomenon which is called ground effect. This can be explained as an effect similar to an increase of aspect ratio of the plane and in consequence, a change in effective angle of attack. With the wing close to the water, the lift at a given angle of attack is actually higher than with the wing in mid-air. The load on the water during the take-off run is therefore less than calculation from wind-tunnel data of the basic airfoil.

The arrangement of the power plant, that is, the combination of engine and propeller and its location on the plane, not only determines the thrust produced during the take-off, but also the moments which tend to nose the plane down.

The limits of trim angle which can be influenced by the pilot during take-off are controlled by the design of the tail surfaces. At the start of the take-off run on water the speed is so low that operation of the elevator produces no moments large enough to overcome the moments produced by the hull when moving through the water, nor the thrust moments of the power plant. At speeds higher than necessary to bring the boat or float to planing on the step, the elevators can be used to obtain a trim angle which is different from the one the plane would assume when left entirely to itself. By changing the trim angle of the hull or float (the angle of the keel base line with the horizontal) there is a change not only in the resistance of the underwater body but also and simultaneously in the lift of the wing, thereby altering the load on the water. This in turn influences the resistance of the underwater body.

Table I gives the weights, wing, engine and hull characteristics of a number of modern flying boats. It can be seen that the values $\sqrt[3]{\text{gross weight}}$/inches of hull beam fall within the limits of .224 to

TABLE I—Hull and airplane design data of a number of modern flying boats

	Fairchild Amphibion A-942 1935	Sikorsky S-40	Sikorsky S-42-A Clipper Pan-Am.	Sikorsky S-43	Martin Clipper Pan-Am.	Short Calcutta 1927	Douglas Dolphin 1935
Gross weight (lbs.)	9700	34,000	38,000	17,541	51,000	19,600	9500
Engine (horsepower)	750	2400	3000	1500	3200	1350	900
Wing area (sq. ft.)	485	1740	1330	780.6	2315	1845	540
Wing loading (lbs./sq. ft.)	20	19.53	28.58	22.47	22	10.62	17.59
Power loading (lbs./h.p.)	12.93	14.16	12.67	11.7	14.91	14.50	10.55
Maximum hull beam (inches)	73	125	115	90	133	120	65
*Forebody length (inches)	208	353	345	250	460	275	204
**Afterbody length (inches)	160	222	230	190	220	260	156
***Total hull length (inches)	368	575	575	440	680	535	360
Hull length/beam	5.04	4.60	5	4.89	5.11	4.46	6
Wing span (ft.)	56	114	114	86	130	93	60
Wing aspect ratio	6.47	7.48	9.78	9.47	7.78		6.67
Lbs. of gross weight per inch of hull beam	132.8	272.0	330	194.9	383.4	163.3	146
$\sqrt[3]{\text{Gross weight}}$	21.3	32.4	33.6	26	37.05	26.9	21.2
$\sqrt[3]{\text{Gross weight}}$/inches of hull beam	.292	.259	.292	.289	.2785	.224	.326

* Bow to main step. ** Main step to second step. *** Bow to second step.

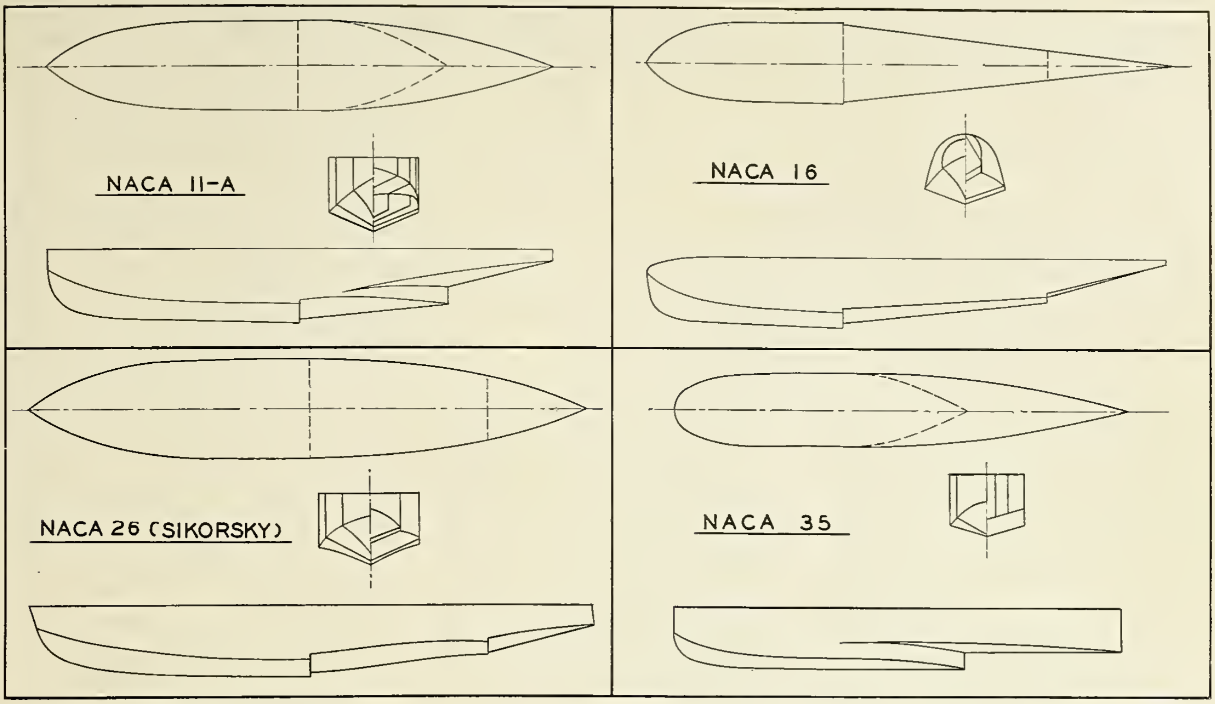


Figure 1: Flying boat hull designs

.326, with a majority of the values between .260 and .290.

A number of flying boat hull models have been tested in recent years in the towing basin of the NACA at Langley Field. Calculation of the maximum beam for a flying boat of 10,000 lbs. gross weight are given in Table II for various hull designs of types as shown in figure 1. Models 11 and 11A are of the conventional V-bottom type with a wide main step and pointed second step. Models S-40 and 16 are V-bottom hulls with two wide steps. Model 35 has pointed main and second steps. In the load coefficient $C_\Delta = \frac{\Delta}{wb^3}$, the load on the water at hump speed, (Δ) is assumed to be 90% of the gross weight; w is the weight of water per cubic foot; and b is the maximum beam of the hull in feet. The factor Δ/R is load on the water over resistance.

For the first estimate a value of .280 can be assumed for the factor: cube root of gross weight in lbs. over maximum hull beam in inches, and the hull will be properly proportioned. The total length from bow to second step shall be approximately five times the maximum beam. For this hull the water resistance at hump speed would be approximately .180 times the gross weight of the plane, if the hull has the lines of NACA 11A, of S-40, or of similar models. The hull lines of NACA Model 35 have not as yet been used on full size boats. Because of the very high values of load on water over resistance shown by this model in float basin tests, it would be interesting to see a boat built on these lines.

It can be assumed that the propeller thrust at planing speed is 3.4-4 lbs./rated h.p., depending on the pitch angles of the propeller and on its speed of rotation. For a geared engine (the propeller of which turns at about 1300 to 1400 r.p.m.) the value 4 is nearly correct, but for direct-drive engines the lower value should be used. This does not pretend to be exact, but is reasonably correct for the purpose for which we are using it. If a constant-speed device is used on a controllable-pitch propeller, or if a propeller is used which allows a manual change of the pitch to maintain maximum engine revolutions, the values of thrust per engine horsepower are approximately 3.60 to 4.20 lbs. Again, the lower value should be used for direct-drive, and the higher value for geared engines.

To obtain a reasonable short take-off of 35-40 secs. for a boat which has a get-

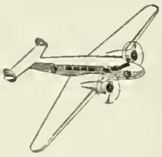
(*Continued on page* 38)

TABLE II—Hull beam calculation for various hull models for boat of 10,000 lbs. gross weight

Type of Hull	11	11-A	Sikorsky S-40	16	35	Empiric Method
NACA TN	464	470	512	471	504	—
$\Delta = .90 \times$ gross weight	9000	9000	9000	9000	9000	—
Load coefficient C_Δ ($C_\Delta = \Delta/Wb^3$) at $\Delta/R = 5.0$ at hump	.26	.46	.42	.37	.92	—
Hull beam (ft.) $\Delta/R = 5.0$	8.15	6.735	6.95	7.24	5.35	—
Load coefficient at C_Δ at $\Delta/R = 4.50$ at hump	.355	.60	.58	.50	1.20	—
Hull beam (ft.) $\Delta/R = 4.50$	7.34	6.17	6.23	6.55	4.89	—
$\sqrt[3]{\text{gross weight}}$/hull beam in in.						.280
Hull beam, (ft.)						6.42

Electrical Generators for Aircraft

JACK DELMONTE



The modern airplane has developed to the extent that a reliable electrical source must be available for the many accessories upon which it is dependent for efficient operation. Electrical starters, communications, heating elements, and electrically-retractable landing gears and flaps are featured on the new-type airplane and there is also the aircraft radio, which has proven invaluable in direction finding, instrument flying, and the reception of weather reports. The electrical generating equipment assumes major importance in meeting the demands of these electrical accessories.

● The storage battery solved the problem of electrical energy on early aircraft, but its weight prompted the adoption of as small a unit as possible. However, the growing electrical necessities required heavier and greater capacity batteries, and the appearance of aircraft electrical generators permitted the progressive development of electrical accessories by furnishing the batteries with unlimited output by a constant charge. Batteries are indispensable to the electrical system, chiefly in the electrical starters, where as much as 100 amperes are required for the more recent types. The generator would not be capable of supplying that much power, even for a short period, and the wide service conditions and speed variations of the prime mover of the generator require that it be voltage regulated by a suitable relay device. The battery tends to stabilize the voltage output of the generator to some extent, and, as a matter of fact, the aircraft electrical supply systems are designed to combine the best features of both.

Table I gives the characteristics of a few of the more accepted types of batteries, affording a comparison with the weights and outputs of the generators discussed later.

TABLE I: AIRCRAFT STORAGE BATTERIES

Ampere-Hours	Volts	Weight (lbs.)	Cycles
10	12	17	50
30	12	38	50
42	12	53	50
65	12	70	50

The cycles in the last column refer to an average number of cycles of charge and discharge possible with at least 75% of the rated ampere-hours (i.e., the life of the storage battery). Capacity, expressed in terms of ampere-hours, is based upon a particular discharge rate, usually five hours for aircraft storage batteries. The more rapid the discharge, the smaller the capacity rating. Using the 42 ampere-hour battery as an example, approximately 100 watts load may be served continuously for five hours. On the other hand, a landing light of 300 watts would drain the same battery in about 45 minutes (based upon a 20-ampere hour capacity). The most common voltage of aircraft electrical systems is 12, though a number of commercial airplanes use 6 volts.

Since the generator terminal voltage must exceed the battery potential in order to charge the battery, generators are designed to give an output of 15 volts for the 12-volt battery, and 7.5 volts for the 6-volt battery. Too high a charging voltage is undesirable as it leads to battery overheating, with a subsequent loss of effectiveness, and voltage regulators and relays are used to properly control the voltage of the charging battery. During flight 50% of the capacity of the uncharged battery is returned in one hour.

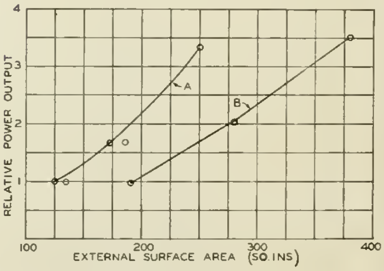
With the introduction of aircraft radios a high potential supply was necessary to the plates of the tubes (as high as 1350 volts are required on some). Three widely-used methods of arriving at high potentials for radio purposes are available: (1) grouping of batteries in series until the desired potential is reached, (2) high voltage windings on either the generator or dynamotor, and (3) alternating current voltage stepped up by transformers and then rectified.

The first is impractical for aircraft because of the weight factor. The second and third methods have been satisfactory for aircraft radios and have introduced a new role for aircraft generators in addition to their charging function. This type of generator, known as a radio generator, not only charges the battery, but also serves as a radio power supply. It incorporates an armature wound with two sets of windings, one leading to the high voltage commutator and the other to the low voltage commutator, and from there to their respective terminals.

Four types of generators have been used for aircraft purposes—hand-driven, wind-driven, engine-driven and independently-driven. The second and third types are widely used by present-day aircraft, the first having been somewhat superceded by the introduction of the other types. Today, discussion revolves about the relative merits of the wind-driven and the engine-driven generator. In Europe the former is almost universally used, while in the United States, the engine-driven class prevails. prompted perhaps, by its extensive adoption in military aviation. The independently-driven generator is not as widely used, being confined by its weight (a gasoline engine serves as its prime mover) to larger craft. It has, however, an advantage in that it will work at all times. whereas the other generators become inoperative if failure of their respective prime movers should occur. Dynamotors, supplied by batteries, are also capable of furnishing high potentials, though for a limited period of time and with a loss of power (the electrical efficiency of the dynamotor is about 55%). This latter method has been in vogue on multi-engined transport and passenger airplanes.

No reference to the generator output appears in Table II, as that is a function of the individual design. While the generator can be designed to meet the demands of the electrical loads, the choice of the prime mover falls among the three categories listed, and from Table II no one type stands out in comparison with the other.

The wind-driven generator will function as long as the velocity of the slipstream is reasonably constant. Special methods of speed control for this type are necessary, among them being a change of the angle of the windmill relative to the airstream (controlled by a lever from



Relation of surface area to output of aircraft generators. A = single voltage type. B = double voltage type

TABLE II: Comparison of Generator Types

	Wind-Driven	Engine-Driven	Independently-Driven
Installation	On fuselage, outside of plane. Adds to drag	On rear of aircraft engine. Limited space	Placed where desired in plane. For large aircraft-auxiliary-engine
Functioning	When plane is in flight	When aircraft engine is operating	As long as gas engine operates
Speed	Function of air blast	1.5 crankshaft speed	Depends on auxiliary engine speed range
Size	Streamlined and limited to reduce drag, and output limitations	Limited by output requirements	Limited by output requirements
Weight (lbs.)	25-50 (usual)	20-40 (usual)	80-100 (incl. aux. engine)
Cooling	Air blast	Surface radiation	Surface radiation
Inspection	Requires disassembly	On removal of covers	On removal of covers
Housing	Fully enclosed	Semi-enclosed	Semi-enclosed

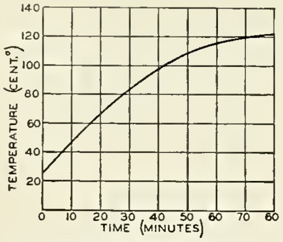
the cockpit); voltage regulators placed in the generator's field circuit; centrifugally governed clutches; and an automatic variable pitch for the fan or impeller. This last method has been the most satisfactory, since the pitch of the blades automatically increases in proportion to the slipstream velocity. The pitch is controlled by centrifugal weights contained in a hub of ellipsoidal form, and this particular generator weighs 29 pounds and provides an output of 180 watts, with two voltage sources of 1350 volts and 7.5 volts.

The added weight of the impeller hub, and streamlined tail of the windmill generator makes it slightly heavier for a given output than the others. Moreover, in designing windmill generators for large outputs, the size of the unit causes an appreciable drag on the airplane.

Independently-driven generators are usually mounted on an auxiliary engine. Requiring no special drive coupling, they are usually driven at about 4000 r.p.m., and weigh about 125 lbs.

The engine-driven generator is geared to a speed higher than the crankshaft speed, giving an average output of from 2000 to 3500 r.p.m., and is designed to safely withstand speeds of 4500 r.p.m. under unusual conditions. Centrifugal forces at high speeds tend to displace the commutator bars, and to fracture the wiring and banding straps, thus requiring special methods of reinforcing the rotor elements. Torsional vibration, resulting from momentary changes in propeller speed can reach harmful proportions, give an undesirable voltage output, and seriously interfere with the life and efficiency of the generator if such a condition was not minimized. These momentary fluctuations of speed that result in excessive torsional vibration are usually absorbed by flexible couplings, through which the driving torque is transmitted to the generator rotor. The drive coupling forms an important part of the generator design, minimizing the torsional vibration and in some cases effecting a speed control.

Attempts are made to effect good voltage regulation on engine-driven generators through the use of voltage regulators or speed control couplings. As voltage output is a function of the speed, and as it has been thought that a constant speed drive would provide the required regulation, a number of the more recent types have appeared with a constant speed coupling, designed to maintain a uniform speed above a designated driving speed. The relays and voltage regulators have been satisfactory, and as there is a common field for the low voltage and high voltage circuits of the double voltage generators, voltage regulation is provided for both circuits. A 5% voltage regulation is considered satisfactory for the low voltage circuit. The voltage regulation, measured at several driving speeds, is calculated as follows:



Typical temperature rise on generator surface—full load

$$\% \text{ regulation} = \frac{\text{voltage (no load)} - \text{voltage (full load)} \times 100}{\text{voltage (full load)}}$$

Low voltage regulation is important during charging operations, as it is imperative that the generator voltage should not fall below the battery potential and allow reverse currents to disturb the plane's electrical system. In addition, a steady and reliable voltage supply is needed for satisfactory radio performance.

Fundamentally designed to furnish a specified output with a minimum of weight, the engine-driven generator is located on the rear of the aircraft engine on a standard mounting flange which permits interchangeability. They are furnished in a number of types, each designed to meet specific requirements. Engine-driven units are mounted differently, the angle of mounting being dependent upon the gearing arrangement of the engine in which the generator is installed. The demands for battery charging and radio power supply, the two major functions of generators, differ with the individual airplane, some of which being more fully equipped electrically than others, require a greater supply of energy and use the greater output generators. The more common types of engine-driven generators are listed in Table III.

TABLE III
SINGLE VOLTAGE GENERATORS—DIRECT CURRENT

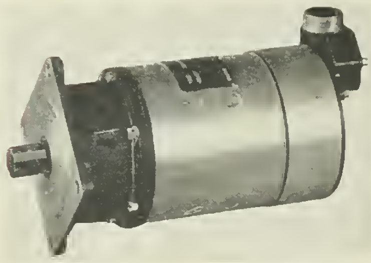
Type	Voltage	Current (Amp.)
G	15	15
D	15	25
E	15	50

DOUBLE VOLTAGE GENERATORS

Type	Low Voltage	High Voltage	Combined Output (Watts)
MB	15 d.c.	500 d.c.	225
MF	15 d.c.	1000 d.c.	450
A	15 d.c.	120 d.c.	800

The chief function of the single voltage generators is battery charging, and they are available in different outputs, suitable for a variety of aircraft electrical demands. Double voltage generators are capable of simultaneously supplying two loads, and the most recent of this class, type A, (an alternator) furnishes alternating current at 120 volts. This may be stepped up in the radio power unit and then rectified for application to the plate circuit. The frequency of the alternating current is dependent upon rotor speed, and consequently there is a constant

Eclipse generator control box



Eclipse engine-driven generator

speed drive for uniform frequency. This frequency is relatively unimportant as long as it is stable once it is established for the radio equipment.

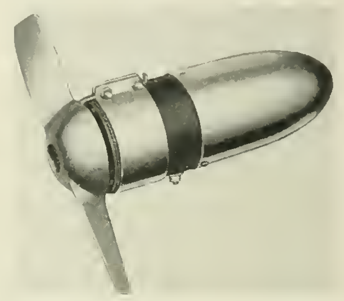
Drive Coupling: Torque from the engine's crankshaft is transmitted through gears to the six-splined driving shaft of the engine-driven generator. These splines, standardized in dimensions for interchangeability, are hardened to a lower value than the engine gears, so that sudden shocks will not be detrimental to the engine gears. Between the splined driving shaft and the rotor assembly is the drive coupling, the spring-drive type being one of the best for reducing torsional vibration to the aircraft generator. The driving shaft transmits its torque through rugged springs to the generator rotor. Another satisfactory form of drive coupling for reducing torsional vibration is the rubber coupling which has been used with small machines where loads are not especially great. The splined driving shaft, through the medium of metal fingers inserted between rubber cylinders, drives the generator rotor. The objection to this coupling lies in the choice of material, for under service operation the rubber shows less longevity in comparision with other parts of the equipment.

In the recent constant speed drive couplings, introduced to assist performance, centrifugally operated clutches engage the generator rotor only when the driving shaft exceeds a certain speed. When the generator is rotating at the engine idling speeds and the voltage is below that of the battery, it will automatically disconnect the driving shaft from the rotor, and eliminate the danger of reversing the generator field polarity by the higher battery voltage.

Bearings: Packed with a suitable high temperature grease, the roller bearings must retain the lubricant for all generator positions, and at all rotational speeds. They are located between the splined driving shaft and the drive coupling, at the non-driving end of the rotor. In the long rotor, double voltage generators, there is a third bearing between the drive coupling and the generator rotor.

Cooling: Though the engine-driven generator is superior to the wind-driven type in voltage characteristics and less liable to vibration, its cooling presented a problem which has been solved by heat resisting insulation and forced ventilation. Located in a high ambient temperature, it is not easy for the aircraft generator to conform to space and weight requirements without excessive temperature rise. The typical temperature rise curve illustrated shows an approximate temperature rise on the outside surface of the engine-driven generator of approximately 100°C in one hour of operation. Within the unit the temperature is exceedingly greater, and as size, weight, and the degree of enclosure do not permit better ventilation, the insulation must be capable of assisting trouble-free operation.

These generators may be cooled by radiation and convection from outside surfaces, by forced ventilation through air ducts, by slight air circulation due to rotating parts, and by heat conduction to cooler metal surfaces. Forced ventilation permits a considerable saving in weight though it offers a handicap by circulating a corrosive atmosphere among the windings. A small finned structure on the yoke may help in increasing the radiation surface. The generator output is definitely related to the amount of radiating surface, as indicated in the accompanying diagram, for several types, and the double voltage generators, with the larger number of windings and the two commutators, are afforded more radiating surface for a given output.



Air Associates wind-driven generator

Efficiency: Electrical efficiency of aircraft engine-driven generators is comparitively low, due to high heat losses. In the neighborhood of 60%, the efficiency is not easily determined as it is difficult to measure the mechanical input from the aircraft engine. Aircraft generators absorb so little of the engine's total horsepower that the performance of the latter with and without the generator can scarcely be differentiated, and consequently, special methods of measuring efficiency are necessary.

Brushes: Sparkless commutation is not easily avoided over varying loads and speeds, especially on the high voltage commutators, and inspection every 25 hours is recommended to observe excessive wear.

Control Bar: Mounted upon a shock proof base, and shielded against radio disturbances, the control box is located in the cockpit. Its functions are to maintain voltage at a constant level, and afford protection against reverse currents and overloads. In addition to the control box, when the storage battery is floating upon the circuit, the minute voltage fluctuations are dampened, so that a reliable and efficient supply may be expected for a wide range of aircraft engine speeds and under varying electrical loads. The weight of the control box is approximately four pounds, the cover and the body being constructed of aluminum alloy. The relay contacts, closing against a spring tension, are adjustable.

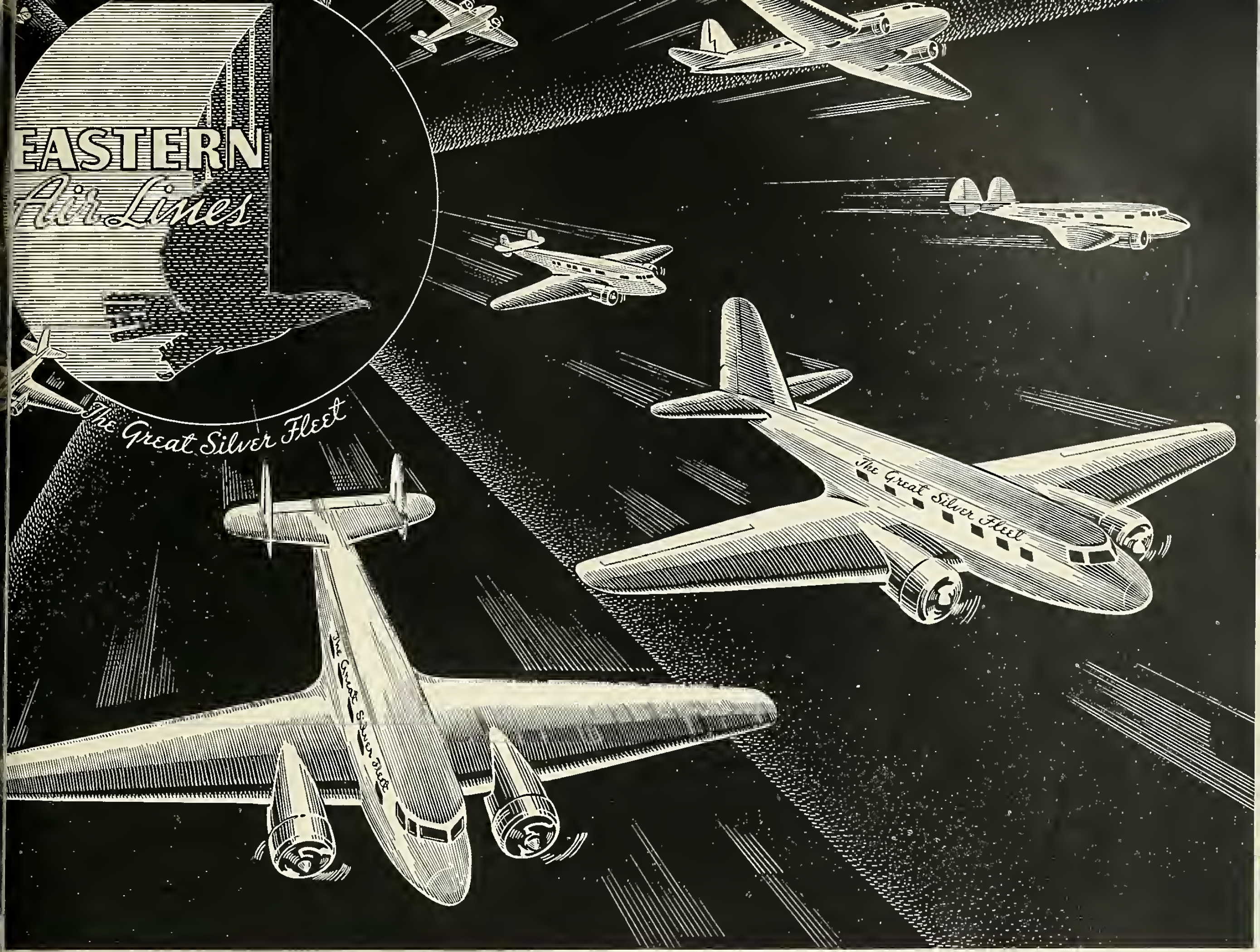
Residual magnetism: As aircraft electrical generators are self-excited (no external supply being necessary to magnetize the fields and induce currents in the rotating armature windings) the steel, though soft, must always maintain sufficient residual magnetism to allow the generator to build up at any time, without flashing the fields.

The reception of faint radio signals makes it necessary to eliminate as far as practical all sources of radio disturbances. The sparking commutator and the high potential windings are the disturbing elements of the generator, and to eliminate their influence, a conveniently placed hand switch for opening the field circuit should be made available to the pilot. The generator (lacking field excitation) will remain inoperative until the circuit is closed. Field rheostats, allowing considerable control over the generator voltage, are sometimes on the instrument panel, and by cutting resistance into the field circuit, lower the voltage output. However, relays are more appropriate when close voltage regulation is necessary for battery charging.

During steep dives propellers with fixed blades turn at an extremely high rate, thus revolving the generator rotor very rapidly. The high centrifugal forces accompanying these speeds have been known to break the windings as they are led to the commutator, necessitating mechanical reinforcement.

A slight ripple may sometimes be present in the voltage output for the MF and the MB types, indicative of momentary changes in electro-magnetic characteristics during one revolution of the generator. This ripple may be eliminated by a filter which is usually mounted in a box upon the outside yoke assembly of the generator.

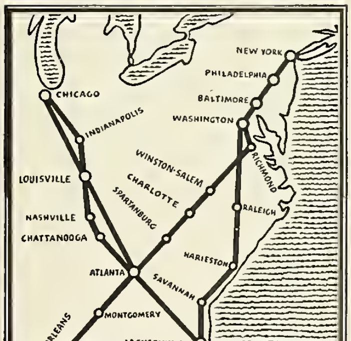
Double voltage generators are designed to furnish voltages ranging from 450 to 1350 volts, depending upon radio requirements. With voltages of these magnitudes about the airplane, precautionary measures should be taken to safeguard personnel. The radio power unit should likewise isolate high voltage connections to further guard against accidental contact.



WRIGHT ENGINES

power the

Great Silver Fleet



Map of Eastern Air Lines System

Eastern Air Lines' "Great Silver Fleet" is powered exclusively by Wright Whirlwinds and Cyclones — a tribute to the quality construction and dependable performance of Wright Aircraft Engines.

Wright Whirlwind 450 h.p. Engines power Eastern Air Lines' fleet of new Lockheed Electra transports. These 200-mile-an-hour planes complement "The Great Silver Fleet" of giant Douglas Airliners, each powered by two Wright Cyclone 750 h.p. Engines.

The Wright Whirlwind-powered Lockheed Electras have been placed on regular schedules between New York and New Orleans, and Chicago and Miami —with intermediate stops shown on the map. These new schedules allow the high-altitude Wright Cyclone-powered Douglas Airliners to hold express schedules over long distances on Eastern Air Lines' great transportation system.

WRIGHT

AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION

SIMPLIFIED AIRPORT RADIO

NORMAN J. CLARK

Consulting Engineer, Aircraft Communications

Airports operated by city and county governments have suffered along with other civic departments in the matter of budget reductions. At a time when the industry is making its greatest progress toward safety and reliability; when the Airways Division, the airline, and commercial operators are cooperating in bringing air transportation to a peak of development not yet attained in older methods of travel, the airport finds that, through lack of funds, it cannot take advantage of new, valuable equipment being offered to further the safety of flight. The accompanying article is intended to suggest a solution to the cost and weight problem in aircraft radio.

Typical transceiver setup, ready for installation in a Stinson Reliant. No shielding or bonding was necessary

● Traffic control at airports is a growing problem which in a short time may become most serious. The increase in private and commercial flying will eventually make Sunday at an airport look like five o'clock at Times Square, and without an efficient method of directing planes in landing and taking off, chaos will result.

Short-range radio is the most efficacious system for controlling air traffic. The only argument put by the airport manager, and by the pilot alike is "the high cost of transmitting installation." Granted, but if a solution of the cost problem can be found, all that remains is to get the airport operator to adopt the result of that solution. This might require, in the case of the municipal field, some explanation to the city fathers of the value of radio in attracting tenants to the airport, and in preventing accidents. When the airport is equipped for radio transmission, the pilots will undoubtedly quickly adopt the necessary apparatus to take advantage of it, if it is sufficiently low in price and weight.

Now for a means of providing the airport with a radio communication system without the necessity of creating a bond issue. While the usual radio equipment is necessarily expensive, there is one portion of the radio frequency spectrum for which transmitting and receiving apparatus can be built at a minimum cost. This is known as the quasi-optical band; that space at the top of the radio range, just before the waves change over from radio to heat and color waves. This band runs from about 7.5 meters (40,000 kilocycles) to ¾ meter (400,000 kilocycles). Fortunately, this band is also better adapted to short haul work on radio telephone than the longer wave lengths. The ultra-high frequencies are exceptionally directional, and lend themselves extremely well to beam transmission.

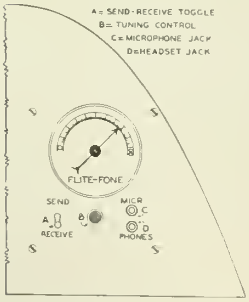
A typical ground station, using quasi-optical transmission, is provided with an antenna that is a simple vertical rod, about eight feet in height. It is fed by a shielded twisted-pair transmission line. Compare this radio system with the conventional airport station, which presents a formidable array of horizontal wires; is an expensive unit to set up, an eyesore and a hazard to low flying ships. The transmitter proper is entirely built into a chassis approximately 10 by 20 inches in planform, and having only two controls, the variable condensers tuning the oscillator and amplifier frequencies. The power supply, audio stages, oscillator and power amplifiers are in one cabinet, meaning that a station will not require extensive space, and can be placed in any corner, or on a flat roof where the operator can observe the air in all directions. The light weight of the unit makes it instantly portable—an important feature.

The receiver will be housed in an aluminum cabinet only about six inches square. The set will include a detector, a suppressor frequency oscillator, and an audio amplifier—three tubes, consuming little current. The plate potential will run from 90 to 135 volts, furnished by dry batteries, which are the simplest source of pure direct current at low cost.

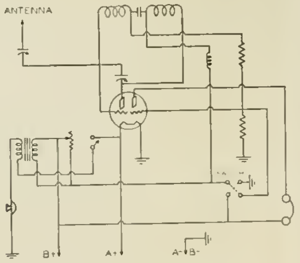
Now for the airplane installation. With this system, the pilot may avail himself of the advantages of two-way communication with little cost and weight. Transmitter and receiver are combined as a single unit. Three tubes—a detector, a long wave oscillator, and an audio amplifier—comprise the receiver. As a transmitter, the detector and oscillator are used, as oscillator and modulator respectively, the audio stage not being used. The microphone and headphones plug into jacks in the front of the cabinet, and the pilot makes either a sending or a receiving set out of the unit by changing the position of a toggle switch marked "Send" and "Receive." The set will be only about seven inches square, and will not weigh over 12 pounds with batteries. In most experimental installations so far, it has been found unnecessary to shield the ignition, as the interference is too low in frequency to affect the carrier wave. No dynamotor, vibrator or other auxiliary power supply will be necessary.

This system for aircraft radio communication will be of obvious benefit not only to the municipal airport, but also to the small commercial field and the flying school operator. It will provide economical and effectual communication between the instructor and his solo student, thus lowering instruction costs. It may also be utilized to advantage by teams of pilots performed at air shows, etc., for interplane communication. Pilots of light planes will derive an extra benefit through the fact that the negligible weight factor will permit the advantages of radio without loss in aircraft performance.

Recent experimentation in the ultra-high frequency band has done much to guarantee the reliable and dependable operation so necessary to aircraft service. The absence of natural and man-made interference (*QRN* and *QRM*), and the positive carrier wave indication, all super-regenerative properties, would seem to conform to aircraft requirements to a greater extent than do the present allotted frequencies.



Radio transceiver panel installation



Circuit of single tube (type 19) mobile transceiver unit

Continuing its effort to bring greater efficiency and safety to air transport, United Air Lines will soon complete the installation of Hamilton Standard Constant Speed Controls on its entire fleet of fifty Wasp-powered Boeings. The Boeings already equipped with this new Hamilton Standard development show substantially increased performance. Any Hamilton Controllable may be equipped with Constant Speed Control as a field modification.

HAMILTON STANDARD PROPELLERS
East Hartford Connecticut
A DIVISION OF UNITED AIRCRAFT MANUFACTURING CORPORATION

The Curtiss-Wright Model 19L COUPE

● The Model 19L *Coupe* has been developed by the Curtiss-Wright Airplane Co. for the Bureau of Air Commerce in their program to obtain a plane to meet the demands of the private owner and average pilot.

Before undertaking construction, extensive studies were made by the company in co-operation with Bureau engineers and to the problems associated with the requirements of these pilots, and under the supervision of Ralph S. Damon its president, engineering and production plans were developed along the lines intended to provide performance, comfort, and safety, as well as low maintenance and operating costs.

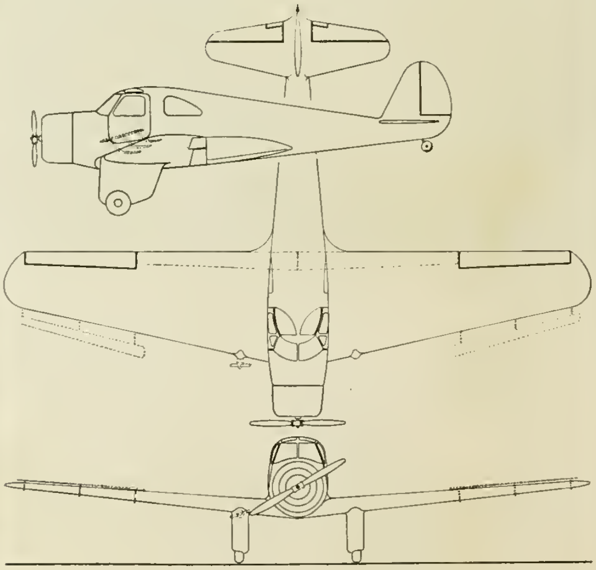
Curtiss-Wright's program for this plane followed definite lines set by Mr. Damon who sought the production of a plane which not only had a low landing speed and ease of control, but also was inexpensive to maintain and operate. Consultations with Chief Engineer George A. Page and C. W. Scott, who was the engineer of the project, resulted in the choice of an all-metal, low-wing design modeled after the transport types flying over most of the nation's airline systems.

Fuselage and Interior

Their efforts culminated in the construction of the two-place cabin monoplane, which, powered by a 90 h.p. Lambert R-266 engine, shows a maximum speed of 131 m.p.h., a cruising speed of 115 m.p.h. at 5000 ft., a normal range of 580 miles, and a fuel consumption of 5.8 gal./hr. With one person, the range of the plane is extended to 1150 miles.

Of all-metal monocoque construction throughout, the skin gauges are of 24ST alclad aluminum. Structure of the fuselage is of raised rings, stringers, and stressed skin. The two-place, side-by-side cabin is equipped with dual controls, the right hand column of which can be easily disconnected when desired. Due to the low position of the engine, the sloping windshield, side windows and transparent roof, visibility is excellent in all essential directions. In the top of the windshield are two automobile-type ventilators, in which are mounted rear view mirrors, affording good vision to the rear

The cowling is hinged for easy access to the engine
Below: Outlines of the Lambert-powered Curtiss-Wright Coupe



for landing. These ventilators are of the no-draft type, sucking air from the cabin. Fresh air is taken into the cabin through a duct opening in front of the engine. Doors are large, one on either side giving access to either front seat, both of which are fitted with spring cushions and upholstered to suit individual customers. Seats are adjustable fore and aft and vertically, the back being hinged to allow access to the baggage compartment.

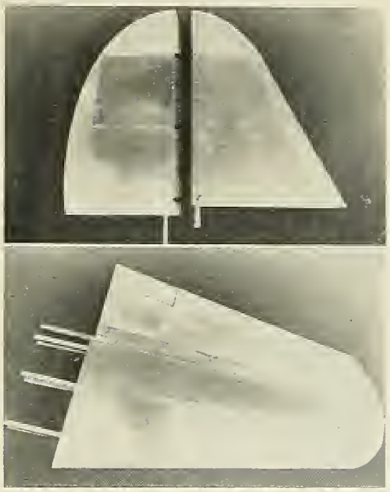
The control column is conventional in design and similar to modern transports, with the exception that it is used in an inverted position, allowing the spade-type aluminum alloy wheel to move directly fore and aft with no obstructions in the cockpit. It is mounted on a hinge between the instrument board and firewall on ball bearings. The wheel shaft is held in place by a bearing at the instrument board. This board consists of a steel structural tube across the cabin, with fittings attached to support a small panel containing a fuel pressure gauge, fuel gauge, altimeter, oil pressure gauge, oil temperature gauge, compass, tachometer, and airspeed indicator. The assembly is covered by a shield which provides for indirect lighting if desired. Rudder pedals are of the automobile type of conventional design and are installed so that only the pedals are visible. Controls are mounted on self-lubricated ball bearings.

Structure of the Wings

Wings are all-metal full cantilever type built up of five spars, with a duralumin skin designed to carry the loads. The attachment angle of the wing extends over the entire surface of the wing and connects directly to the fuselage through a double-riveted joint. Additional reinforcement is obtained from the wing-fuselage fillet which forms one complete unit. Ailerons are attached to the wing by a full length piano-type hinge and in order to improve aileron control they are locked against down travel past the neutral position. This is accomplished by a combination of an idler link in connection with the control rod, whereby the pulleys are made to rotate idly when the aileron reaches the neutral position on its downward travel, even though they are rigidly and directly connected with the opposite aileron control mechanism.

Flaps, Tail and Landing Gear

There is a split flap on the trailing edge of the wing extending 70% of its span and operated by a rotating handle (of the same type as automobile window lifts) located at the pilot's right near the bottom of the seat. Unlike conventional flap actuating mechanisms, this is so operated through torque tubes that the load on the handle remains almost constant regardless of air load. The flap actuating mechanism is attached to the flap at five points, each position being adjustable. A fixed auxiliary airfoil, or slot, is used on the outer tips of each wing at the leading edge extending the same length as the ailerons. These are designed and located to give best aileron control, eliminate the possibility of inadvertent spinning, lower the landing speed, and to give smooth stall with good lateral and directional stability.


Fin and rudder units, and below one of the horizontal tail surfaces

Tail construction is similar to the wing. The stabilizer and fin are of the fixed type, with metal trim tabs on the elevators, operated by a Breeze irreversible mechanism. Elevators and rudder are of all-metal construction, the elevators having a piano-type hinge, extending from the tip to the root section. The rudder has a fixed tab adjustable on the ground.

A full monocoque landing gear with a 10 in. oleo stroke and full air wheels is used. The landing gear is held in the take-off position by a small latch in the oleo, which is automatically released on the first turn of the flap. The gear is so hinged that it has a large angle to the c.g. of the airplane at the moment of impact, this angle slowly decreasing as the oleo is collapsed, until it finally becomes slightly larger than is normally used, thus shortening both take-off and landing runs. Hydraulic brakes, both foot and parking are used, the latter being a sliding control on the instrument board that operates a screw stop on the hydraulic cylinder.

Engine Mounting

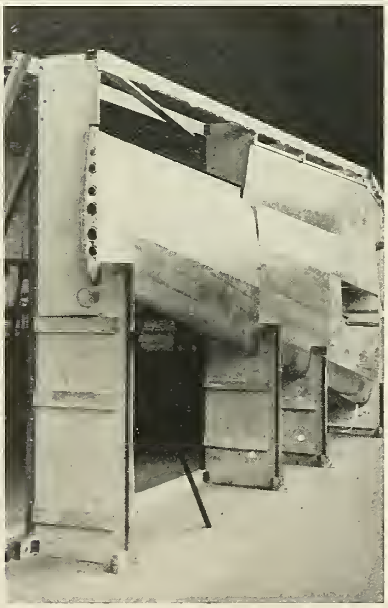
The engine is mounted on a steel tubular structure, and is supported with rubber bushings to absorb vibration. No part of the cowl attaches directly to the engine, allowing it to move freely inside the shell. The cowling is supported by steel tubes from the engine mount, and has a piano-type hinge running along the top side, and it can be dismantled as a unit from the engine by removing three pins which hold the hinge to a steel tube. It can also be lifted in a semi-unit by loosening three attachments at the sides on either side.

Maximum fuel capacity of the Model 19L *Coupe* is 52 gallons, contained in two tanks located on either side of the fuselage in the wing. Six gallons in the left tank are held in reserve. The oil tank, of 5 gallons capacity, is attached to the firewall directly behind the engine, and is mounted on felt pads to absorb vibration.

Specifications and Performance

Specifications and performance figures of the Curtiss-Wright Model 19L *Coupe* are as follows:

Wing span	35 feet
Length overall	25 feet 6.5 inches
Height overall	7 feet 2 inches
Wing area	174 square feet
Wing loading	10.3 lbs./sq. ft.
Power loading	19.9 lbs./h.p.
Stabilizer area	18 square feet
Elevator area	10 square feet
Rudder area	4.5 square feet
Aileron area	11.9 square feet
Empty weight	1154 pounds
Useful load	646 pounds
Gross weight	1800 pounds
Fuel capacity	52 gallons
Oil capacity	5 gallons
Maximum speed	131 miles per hour
Cruising speed	115 miles per hour
Stalling speed	44 miles per hour
Rate of climb	500 feet per minute
Ceiling	17,000 feet
Cruising range (normal)	580 miles
Cruising range (maximum)	1150 miles


The all-metal Coupe wing in jigs

Inverted Cirrus "Major" Engine

● British Air Ministry tests have been completed on the *Major*, a new four-cylinder, in-line, inverted, direct drive, air-cooled engine produced by Cirrus-Hermes Engineering Co., Ltd., of Hough, England. This engine delivers 125 h.p. at its cruising speed of 2100 r.p.m., and a maximum of 135 h.p. at 2350 r.p.m. It has a stroke of 5.51 in., a bore of 4.72 in., and a 5.1:1 compression ratio. Complete with accessories it weighs approximately 310 lbs., and measures about 17.5 in. at its widest point, 28 in. high at the front, 30 in. at the rear, and almost 50 in. in overall length with starter and spinner.

Cylinders are machined all over from steel forgings which are located in the crankcase by spigots. They are held by bolts which secure the cylinder heads. The hiduminium cylinder heads are detachable, are provided with a large cooling area, and are designed along lines similar to the model used on the Hermes IV A engine. A gas tight joint is secured by laminated copper washers, and all valve gear, valves, etc., are interchangeable with the exception of the valve rockers of which four are right and four left handed.

Pistons are the full skirt type and are of heat treated "Y" aluminum alloy with two compression and two scraper rings to each. The gudgeon pin is of the full floating type.

Connecting rods are hiduminium forgings of heavy section equipped with ground white metal lined steel shells.

The crankshaft is a steel forging carried in five die-cast bearings located in the main bearing caps. A journal ball bearing is fitted at the front end to absorb propeller thrust. The shaft is foreshortened and the propeller boss is so designed that removal and refitting of the propeller is simple. A dog for starter is fitted at the rear end.

A simple train of spur gears drives the camshaft which is carried in five bronze bearings fitted in the crankcase. The rear end has a tongue for any auxiliary drive which may be required.

Valves are made from K.E.965 and are interchangeable as either inlet or exhaust. A hardened tip, fitted to the end of the stem, is replaceable. They are operated from the camshaft by one piece cup ended tappets passing through phosphor bronze guides, and ball ended push rods. Push rods are located in an adjustable cup in the end of the rocker arms, and renewable hardened pads are fitted at the other end of the rocker arms making contact with the valves.

The main crankcase is an aluminum casting having a cover of elektron casting which carries a breather cast integral with it at the rear end. It is provided with lifting eyes.

The oil pump is of the oscillating piston type and is housed with the suction and pressure filters in one casting at the rear of the crankcase, direct connection being made to the oil ducts in the casting without external tubing.

Standard equipment includes an induction manifold, carburetor, two magnetos, propeller boss and spinner, cylinder cooling chute and baffles, oil pump and filter, and controls.

At cruising speed the *Major* has a fuel consumption of .54 pint/h.p./hr., and .58 pint/h.p./hr. at maximum r.p.m. Oil consumption is 1 pint per hour.

Recent Aeronautical Patents

The following patents of interest to readers of AERO DIGEST recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Aircraft wheel. Alexander C. Hamilton, Pleasant Ridge, Mich., assignor to Hayes Industries, Inc., Jackson, Mich. (2,012,449)

Propulsion means. Steve Kiss, Miami, Fla. (2,012,568)

Flying apparatus. Steffen P. Nemeth, Chicago, Ill. (2,012,768)

Rotating wing system, propeller, or lifting screw for aircraft; adjustable wing, plane, or blade of airplanes, helicopters, propellers, or like, and rotating wing system, propeller, or lifting screw for aircraft. Rudolph Chillingworth, Brooklyn, N. Y. (2,012,987, 2,012,988; and 2,012,989)

Supporting propeller shafts. Hugo Junkers, Dessau, Germany. (2,012,997)

Flying machine. Everett Phillips, Leesburg, Va. (2,013,250)

Abrasion shoe for airfoils. Harry E. Waner, Akron, Ohio, assignor to B. F. Goodrich Co. (2,013,323)

Parachute. Doss W. Kennedy, Matthews, Mo. (2,013,495)

Propeller construction. Jess W. Base, Taft, Calif. (2,013,647)

Airplane engine synchronizing device. Frederick R. Sias, Coral Gables, Fla. (2,013,673)

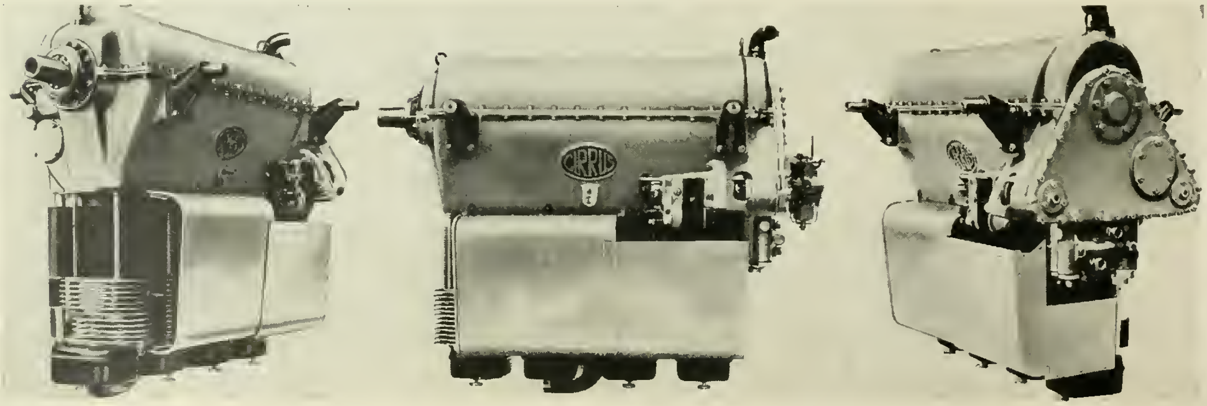
Message-carrying signal apparatus for airplanes. Christopher C. Holmes, Los Angeles, Calif. (2,013,729)

Adjustable pitch propeller. John Squires, Hagerstown Md. (2,013,930)

Fabrics for airplane construction and process and composition for making same. James E. Hutchman, Newburgh, N. Y. (2,014,068)

Flapping wing for airplanes, gliders, and like. Richard Gargiulo, New York, N. Y. (2,014,251)

(Continued on following page)



The 4-cylinder inverted British Cirrus "Major" rated 135 h.p. at 2350 r.p.m.

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(Continued from preceding page)

Harness for quick-attachable chest packs, and lift web for packs and harness. Stanley Switlik, Trenton, N. J. (2,014,344 and 2,014,345)

Airplane. Giuseppe M. Bellanca, New Castle, Del. (2,014,366)

Flying machine. James J. Fitzgerald, New York, N. Y. (2,014,377)

Heavier-than-air flying machine. Felix F. von Wilmowsky, New York, N. Y. (2,014,457)

Airplane mail pickup. Elmer Clampitt, Indianapolis, Ind. (2,014,557)

Wing construction. Robert R. Osborn, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,014,776)

Retractable landing gear. Samuel T. Payne, Kenmore, and Frederick R. Weymouth, Buffalo, N. Y., assignors to Curtiss Aeroplane & Motor Co. (2,014,777)

Adapter for twin flexible machine guns. Clem G. Trimbach, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,014,793)

Rib construction. Fredic Flader, Buffalo, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,014,801)

Aircraft provided with a gun. Marc Birkigt, Bois-Colombes, France. (2,014,876)

Automatic means for counteracting nose dives in aeroplanes. Max M. Weiss, Brooklyn, N. Y. (2,015,047)

Self-synchronous automatic pilot. Frederick S. Hodgman, Glen Rock, N. J., assignor to Sperry Gyroscope Co. (2,015,183)

Beacon light. Abraham Sprung, New York, N. Y. (2,015,442)

Airplane. Frank Tupta, Cleveland. Ohio. (2,015,444)

Directional gyroscope. Mortimer F. Bates, Brooklyn, N. Y., assignor to Sperry Gyroscope Co. (2,015,650)

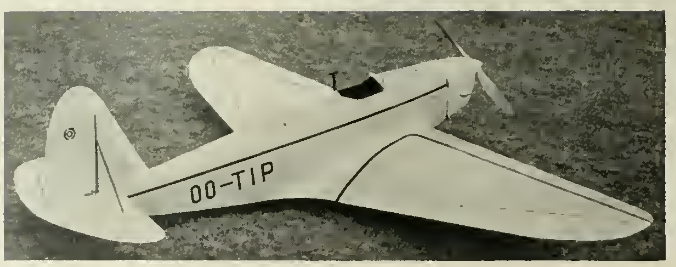
Aircraft direction finder. William S. Webster, Palmyra, N. Y., assignor to Radio Corp. of America. (2,015,828)

Folding wing. Ignacio Izsak and Vincent Bukletish, Chicago, Ill. (2,015,898)

Fire preventing and extinguishing system for aircraft. Claire L. Egtvedt, Seattle, Wash., assignor to Boeing Airplane Co. (2,015,995)

Parachute apparatus. Leslie L. Irvin, Letchworth, Herts, England, assignor to Irving Air Chute Co., Buffalo, N. Y. (2,016,235 and 2,016,236)

Means for reducing the resistance of air-cooled motors and like on aircraft. Albert P. Thurston, London, England. (2,016,582)



The "Tipsy" Sport Airplane

A New Light Single-Seater Produced in Belgium

● E. O. Tips, managing director of the Fairey Company in Belgium, has built a new light one-place low wing monoplane for sport and pleasure flying.

Powered by a two-cylinder horizontally-opposed Douglas of 500 cc or by a 540 cc Aubier-Dunne engine, the plane, which is known as the *Tipsy,* attains a maximum speed of 81 m.p.h., and 93 m.p.h. respectively.

The fuselage is all-wood, composed of four spruce longerons with spruce frames, and covered all over with birch plywood. It is constructed in two sections, both joining at a line with the trailing edge of the wing, a feature being the integral construction of the front fuselage section and the wings. The front and rear fuselage sections are detachable, being held together by 4 nickel steel fittings. The cockpit is at the center of gravity of the plane, and is equipped with all instruments for sport flying, an Elektron parachute seat, and a compartment for maps and light luggage.

Wings are also of all-wood construction, composed of a main spar, of "I" section, located at the deepest point of the wing section about one-quarter of the chord, and an auxiliary longeron. Between the spars is a rigid diagonal pyramid bracing which meets at the leading edge of the wing and serves to maintain its torsional rigidity. The leading edge is plywood covered and the balance of the wing is covered by fabric. At the root an R.A.F. 48 wing section is used, tapering to R.A.F. 38 and 28. Ailerons are differentially operated.

Plywood covering is also utilized on the fin which is built integral with the rear fuselage section. Bracing is by two streamlined steel tubes which contain the controls. The rudder is fabric-covered, has a plywood leading edge and is adjustable on the ground. Elevators also are fabric-covered. Rudder and fin are located forward of the stabilizer and elevators so as not to be screened by these members when at steep angles of flight, or during recovery from a spin.

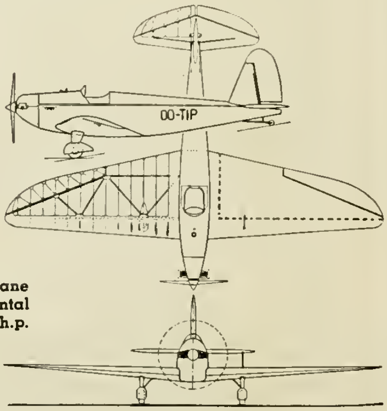
The landing gear has a tread of 6 feet 6 inches and is equipped with low-pressure airwheels held in forks which are attached at three points to the main fuselage longeron, the attachment point being provided with rubber bushings. Pants of Elektron cover the wheels and a streamlined housing of the same metal is used to fair over the forks.

Engine mounting is of welded and riveted steel tubing, and the fireproof bulkhead, tanks and cowling are of aluminum, protected against corrosion by the anodic process of oxidation.

Specifications and performance figures with the Douglas engine, are as follows:

Wing span	24 feet 6 inches
Length overall	18 feet 9 inches
Height overall	4 feet 9 inches
Wing area	100 square feet
Empty weight	287 pounds
Useful load	264 pounds
Gross weight	551 pounds
Maximum speed	81 miles per hour
Landing speed	40 miles per hour

The "Tipsy" monoplane powered by a horizontal engine of about 15 h.p.



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FLYING BOAT TAKE-OFF

(*Continued from page* 25)

away speed of 65-70 m.p.h., the excess thrust at the hump speed shall be approximately 25% of the water resistance at the hump speed.

A flying boat of 10,000 lbs. gross weight, with a maximum hull beam of $\sqrt[3]{10,000/.280}$ = 77 in., would have water drag at hump speed of approximately .180 × 10,000 = 1800 lbs. To give a take-off time of 35-40 secs. the engine required for this boat must deliver a thrust of 1800 × 1.25 = 2250 lbs. A geared engine with fixed or two-pitch setting propeller would have to have 2250/4 = 563 b.h.p., and a direct-drive engine must develop 2250/3.5 = 643 b.h.p. For propellers with a constant-speed device, the figures would be 517 b.h.p. and 600 b.h.p. respectively.

Figure 2 gives an approximation of excess thrust required to obtain a given take-off time on water in calm air, and has been calculated for a plane with a get-away speed of 65 m.p.h. The excess thrust must be higher for planes with higher get-away speed.

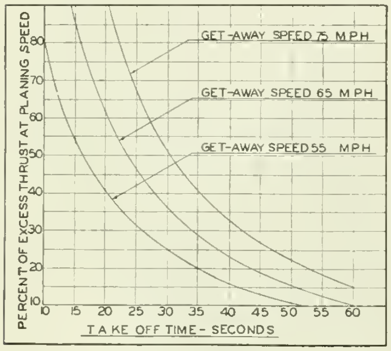

Figure 2: Excess thrust required to obtain given take-off time

One requirement for obtaining a Department of Commerce approved type certificate for flying boats is that the take-off from water shall be made in not more than 45 secs. From figure 2 the required excess thrust at hump speed would then be about 19% of the water resistance for a plane that has a get-away speed of 65 m.p.h.

Hull models have been tested in the NACA towing basin with various loads. The test values indicate that the method, described here for a quick estimate of hull size and of water take-off time, can be used also when the gross weight of a plane with given hull is being reduced or increased. The water resistance is in general decreasing at a higher rate than the decrease of gross weight. If the water resistance is therefore reduced at the same percentage as the gross weight, the calculation will be on the conservative side.

A sample calculation is given here to demonstrate the use of this approximate method. The following design data of the boat is provided:

Gross weight	10,000 lbs.
Wing area	526 sq. ft.
Engine, geared 700 b.h.p. for take-off	
Wing loading	19 lbs./sq. ft.
Maximum lift coefficient	1.65
Stalling speed, sea level	67.2 m.p.h.

From this data is calculated:

Hull beam: $\sqrt[3]{10,000/.280}$ = 6.42 ft.

Water resistance of hull at hump speed: 10,000 lbs. × .180 = 1800 lbs.

Propeller thrust at hump speed: 700 h.p. × 4 lb./h.p. = 2800 lbs.

Excess thrust	1000 lbs.
Excess thrust in % of water resistance:	55.6
Take-off time from figure 2; get-away speed 70 m.p.h.	25 secs.

If the available engine power is reduced to 600 b.h.p., the available thrust at hump speed becomes 2400 lbs. The excess thrust is 600 lbs. or 33.3% of the water resistance, and the take-off time becomes approximately 34 seconds.

With a direct-drive engine of 650 b.h.p. the excess thrust is 410 lbs. or 22.8% of the water resistance, and the take-off time would be approximately 45 seconds.

These values of take-off time check rather closely with calculations made by a more exact method and with results of flight tests on a number of existing planes. It must be remembered, however, that this method is not given as a substitute for the exact investigations, but merely as a help during first layouts and for estimation of the effect of changes in weight or power plant on existing planes.

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Aerodynamics

Determination of the Core of Vortices Resulting from the Distortion of the Area of Separation behind the Wing and Calculations of the Kinetic Energy Induced by It in the Air (Determinazione dei nuclei vorticosi risultanti dall'arrotolamento della superficie di discontinuità dietro a un'ala e calcolo della forza viva da essi indotta nell'aria), C. Ferrari. Laboratorio di Aeronautica della R. Scuolo di Ingegneria, Report No. 65 (*Reprinted from publication of Reale Accademia d'Italia*), 1935, *pp.* 249-268, 5 *figs.*

FORM AND dimensions of the core of the vortices which result from the distortion of the area of separation which forms the trail of a lifting surface are determined with the use of the first approximation followed by Betz. He shows the validity of the hypothesis by this assumption and that it is permissible in the present research by means of the principle of the conservation of energy as long as the kinetic energy of the core of the vortices determined is equal to that corresponding to the first vortex sheets of its distortion.

Magnesium Alloys

Research on the Thermal Analysis of Ternary Alloys. Application to the Magnesium-Silicium-Zinc Alloys Rich in Magnesium (Recherches sur l'analyse thermique des alliages ternaires. Application aux alliages magnésium-silicium-zinc riches en magnésium), E. Elchardus. Publications Scientifiques et Techniques du Ministère de l'Air, No. 70, 1935, 131 *pp.*, 129 *figs.*, 30 *tables.*

VARIOUS IMPURITIES which damage magnesium during melting are studied, with special reference to those brought about by the gases in the atmosphere, particularly to nitrogen. The author describes methods he has perfected for the protection and regeneration of magnesium and for mixing the impurities, and gives the results of a thermal study of salt systems utilized in the melting of magnesium. He explains a very sensitive apparatus which he has developed for establishing an equilibrium diagram of the ternary alloys, magnesium-silicium-zinc, rich in magnesium. His new arrangement for the study of certain physical or mechanical properties of the alloys is discussed, as for example an apparatus to measure the electrical conductivity in functions of the temperature.

Airplane Fuselages

Examples of the Replacement of a Diagonal in the Framework of a Fuselage by a System of Bars (Przyklady zastapienia przekatni zespołem prętów w kratownicy kadluba), A. Grzędzielski and E. Kosko. Sprawozdania, Instytut Badań Technicznych Lotnictwa (Polish Institute of Aeronautical Research), No. 2 (17), 1935, *Report No.* 68, *pp.* 5-19.

FORMULAS ARE given for calculating the forces acting in the framework of an airplane fuselage when the diagonals are replaced by a system of bars. Three cases are considered covering the replacement of a diagonal by a system not projecting from the plane of the outer framework, and the substitution of a pyramid and of a hexahedral, respectively, in place of a diagonal in the framework.

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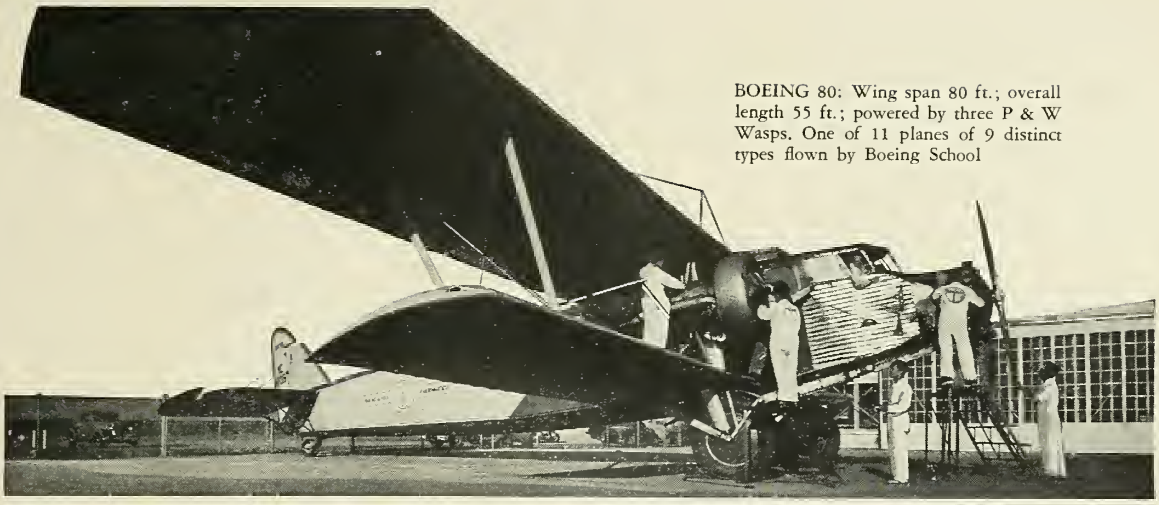

BOEING 80: Wing span 80 ft.; overall length 55 ft.; powered by three P & W Wasps. One of 11 planes of 9 distinct types flown by Boeing School

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(Continued from preceding page)

Whirlwinds

Phenomena in Revolving Fluids (Phénomènes dans les fluides tournants), H. Bouasse. Publications Scientifiques et Techniques du Ministère de l'Air, No. 67, 1935, 226 *pp.,* 98 *figs.*

IN ORDER to study the phenomena of whirlwinds, the author began with an investigation of liquids in a container which is rotated or has a revolving disk or frame to produce the rotation in the liquid. He points out that in the interior of the eddy there exists a more or less complicated circulation but the eddy is always strictly limited by an annular counter-current which gives it its individuality. He gives the conditions of equilibrium in a revolving fluid and describes in detail the apparatus used and the calculations involved for interpreting the phenomena. He applies these results to phenomena in revolving air and criticizes the work of Weyher on artificial whirlwinds in air.

Air-Jacketed Engines

Cooling of an Air-Jacketed Engine, A. S. Hartshorn. (British) Aeronautical Research Committee—Reports and Memoranda No. 1641, *June,* 1934 *(published October* 3, 1935), 55 *pp.,* 18 *figs. on supplementary sheets, 7 tables.*

IN THE alternative method to the Townend ring cowling for aircraft engines, which is described, the cooling air is provided by a fan driven from the engine and inlets and outlets are arranged so that the flow is independent of the flight speed. The engine is fully enclosed in a fuselage of streamline form which has a lower drag than a fuselage with an exposed or semi-exposed engine. From the data given it is estimated that the total excess power required to provide a given rate of heat dissipation for the air-jacketed installation is considerably less than with a normally cowled engine and may be decreased still further by the incorporation of a method for regulating the cooling flow over the cylinders.

Wing Flaps

Wing Brake Flaps, H. B. Irving. Aircraft Engineering, Vol. 7, No. 78, August, 1935, *pp.* 189-197, 18 *figs. Bibliography.*

THE PRESENT position of wing flaps for airplanes is surveyed and their properties and means for operation are compared. Various types of flaps and their general aerodynamic properties, as well as the effects of the flaps on the behavior of the airplane, are discussed. Examples of the effect of certain flaps on the landing run are given with an indication as to the relative importance of the increase in lift and gliding angle due to flaps.

The effects of flaps on longitudinal trim and control are taken up and the difficult problem of lateral stability and control is explained, the lateral stability more particularly in relation to partial-span flaps on tapered wings. The section on lateral control relates chiefly to flaps of such long span as to preclude the use of conventional ailerons.

Monospar Wings

Calculation of a Monospar Wing (Obliczenie skrzydla jednodzwigarowego), W. Billewicz and A. Grzędzielski. Sprawozdania, Instytut Badań Technicznych Lotnictwa (Polish Institute of Aeronautical Research), No. 2 (17), 1935, *Report No.* 69, *pp.* 20-48, 17 *figs. In both Polish and French.*

THE THEORY of the rigidity of the monospar wing and the forces acting upon it are discussed. Two types of spars are considered, the simple tubular spar and the combination of a box spar with a tube which with the leading edge forms the flanges which take the forces normal to the section. The calculations cover the center of torsion of a section formed by the covering and flanges, a section with and without an interior wall, the center of torsion of a section containing one interior wall, and the calculation of the coefficient of elasticity.

Engine Temperatures

Determination of the Temperature of the Gases during Expansion in Internal Combustion Engines (Détermination des températures de gaz pendant la détente dans les moteurs à explosion), M. Doncescu. Publications Scientifiques et Techniques du Ministère de l'Air, Service des Recherches de l'Aéronautique, No. 69, 1935, 63 *pp.,* 20 *figs. Bibliography.*

THE OBJECT of the research described was to determine from the variations of the thermal element of temperature during expansion, other elements relating to the operation of the engine, such as the polytropic exponent of the burning gases, and the loss of heat to the walls during expansion under different conditions of operation and for various fuels. The author discusses the principal research undertaken up to the present and compares the results with those he has obtained. He describes his experiments utilizing the method of Féry for measuring temperatures of a flame not illuminated, and founded on the law of Kirchoff. He describes an engine specially designed for the Service for the spectrography of flames.

It was found that in function of the rotating speed, the temperatures at the beginning of expansion were much higher when the speed was lower, while at the end of expansion the temperatures were lower, the lower the speed. In function of the compression ratio, at the beginning of expansion, the temperatures were greater when the compression ratio increased but at the end were nearly the same.

Supersonic Wind Tunnels

Experimental Contribution to the Study of Supersonic Wind Tunnels (Contribution expérimentale à l'étude des souffleries supersonique), L. Santon. Publications Scientifique et Techniques du Ministère de l'Air, No. 68, 1935, 87 *pp.,* 48 *figs.,* 18 *tables.*

SPEEDS BETWEEN 1 and 2.5 times the velocity of sound were systematically developed in the experiments described and the laws relating to them were ascertained. Both suction and expansion blowers were adapted to the tests, and the latter was constructed to give a plane flow which the author studied by optical means, such as the method of shadows, interferometry (to which was added a variation of the strioscope), the method of non-deviating rays, and the high-speed motion-picture camera.

The author verifies the formula of Saint-Venant, giving the relation of the speed in function of the nozzle section, and explains why Prandtl's formula taking account of the passage from supersonic to subsonic speeds is not verified by his experiments. The best form of nozzle has been determined as well as the facility with which the supersonic streamline vein may diverge. Flow around cylinders and wings in a nozzle was studied and the drag measured by one- and two-component balances specially designed for the tests. The practical impossibility of measuring high speeds with the hot-wire anemometer is pointed out.

Seaplane Hulls

Measurements of Water Pressure on the Hull of a Boat Seaplane, E. T. Jones and W. H. Davies. (British) Aeronautical Research Committee — Reports and Memoranda No. 1638, *March,* 1934 *(Published August* 29, 1935) 46 *pp.,* 56 *figs. on supplementary plates.*

THE PRESSURE over the hull bottom of a Southampton boat seaplane was recorded at 23 stations during a series of normal landings and take-offs at different weights, and during abnormal landings at one weight, as well as in a 3½ ft. sea. It was found that the intensity of pressure during normal landing in calm water was higher than during take-offs. The area over which the pressure extended was from the front step to a point along the keel about a beam length forward of the step. The mean pressure intensity over this area, irrespective of time was about 7 lb./sq. in. at the normal load of 15,300 lb., and varied approximately as $W^{1.7}$, while the mean simultaneous pressure was only about 4 lb./sq. in. Local pressures of 30 lb./sq. in. were recorded twice. High pressures were distributed over a larger area during normal landings and take-offs in a rough sea than during abnormal landings made in a calm sea. From 5 ft. forward of the main step to that step, the hull skin was progressively distorted during the tests.

Wing Pressure Distribution

Pressure Distribution on Wings with Ailerons, W. L. Cowley and G. A. McMillan. (British) Aeronautical Research Committee—Reports and Memoranda No. 1625, *May* 14, 1934 (*published October* 3, 1935), *73 pp., 7 tables, 20 figs. on supplementary sheets.*

PRESSURE DISTRIBUTION was measured over the wings and ailerons of a large six-engined commercial flying boat in order to investigate the possibility of loss of aileron effectiveness due to the twisting of the wings under the aileron loads. From the measurements, the loads and positions of the center of pressure at each section of wing and aileron are calculated under each condition of test.

Rocket Propulsion

Rocket Propulsion, W. Ley. Aircraft Engineering, Vol. 7, No. 79, September, 1935, *pp.* 227-231, 10 *figs.*

THE THEORY of rocket propulsion is explained and an account given of the practical experiments made to date. The fundamental mathematics of rockets are reviewed and the problems of fuels and materials for construction discussed. The design of rocket motors tested in the United States, Germany and Austria is taken up with special attention to motor cooling and fuel injection. Devices to bring the rocket back and to locate it are described and the questions of its efficiency and air resistance are also covered.

Motor-Driven Aircraft Antenna Reel

● With the advent of the high speed airplane, the old type trailing wire pendant antenna was abandoned in favor of the fixed antenna or short trailing wire, both of which have low radiation efficiency. One of the newest developments along these lines is the 8.375-lb. electrically-operated Heintz & Kaufman motor-driven aircraft antenna reel which automatically feeds out and rewinds a trailing wire antenna during flight.

Known as Type 168, this reel has been evolved to effect the advantages of the pendant antenna without the hazards of a permanent short trailing wire or its short-life.

By adjusting the length of the aerial to ¼ wave length of the transmitting wave, high efficiencies may be realized without the need of antenna loading devices. This adjustment problem has resulted in the development of two control units. One, a 2.5-lb. single wave control, allows two positions only, either out to a preset length, or all the way in. The other, a 3.75-lb. multi-wave control, permits any desired length, to be used, the amount being indicated on a dial located near the pilot. Either unit may be used with the antenna reel assembly, and each is furnished with a motor reversing relay.

The design incorporates radial ball bearings, hardened tungsten steel feed rolls, Mycalex insulation, etc., for efficiency and longevity. Safety features are provided in automatic stops which prevent the wire from running completely out of the reel or being drawn too far into it when the end is broken off. With the multi-wave control, if the wire does break, the correct length will still be fed out and the control will indicate correctly as long as there is sufficient wire. Approximately 150 ft. of wire may be wound on the reel.

An antenna stabilizer is attached to the free end of the wire to keep vibration at a minimum and it practically eliminates the customary whip which breaks the wire near its end. The company has also developed an aircraft radio frequency transmission line for use with the reel. It is of light weight, co-axial construction and its impedance is matched to the particular reel system.

The method of installing the antenna reel and its components depends largely on the type of airplane in which it is to operate. In general, the reel is mounted in the tailcone about 8 in. from the apex, the distance being non-critical. The Bowden wire housing, however, should be made as short as possible. The antenna feed-out insulator is mounted in the apex of the tailcone or on the underside.

Separate mounting accessories assist materially in many installations. A soft aluminum feed-out insulator mounting can be formed to the contour of the tailcone, or a right-angled mounting plate can be utilized for the reel assembly.

The reel is rigidly mounted so that there is maximum clearance to the tailcone, thus providing for maximum insulation and minimum capacity to the shell of the ship. The reel and antenna feed-out insulator are lined up so that the Bowden wire experiences as little curvature as possible, and the antenna wire is placed so that it slides freely through the switch mechanism and the Bowden wire.

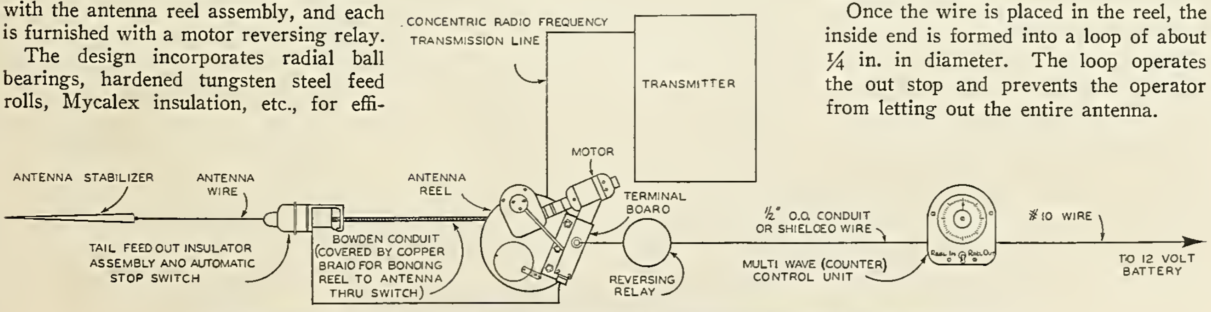
The compartment containing the antenna reel is closed off for protection from objects thrown off by the tail wheel or skid and a copper braid covering is provided for the Bowden wire. This covering is bonded to the tail feed-out and to the reel, thus providing a low resistance path for the radio frequency currents. The relay may be mounted any place in the tail compartment that is convenient and accessible.

Mounting of the multi-wave control is in the pilot's cockpit within easy access, with suitable brackets made to fit the control. If a panel-mounting of the control is desired, the front cover is removed and use is made of the existing tapped holes.

Experience will dictate a determination of the correct operating lengths of the antenna at the various operating frequencies. It is necessary that the antenna be so adjusted that there is an impedance match between it and the transmission line. In general, the antenna length required is slightly in excess of ¼ wave length. This adjustment is critical and should be made to one foot.

In operating the reel, the desired length is set on the counter dial and the switch turned to reel out. The antenna reels out to the desired setting, the correct length being indicated on the dial in feet. The antenna is reeled by throwing the switch to reel in, and the dial returns automatically to zero.

Once the wire is placed in the reel, the inside end is formed into a loop of about ¼ in. in diameter. The loop operates the out stop and prevents the operator from letting out the entire antenna.


CONCENTRIC RADIO FREQUENCY TRANSMISSION LINE
TRANSMITTER
MOTOR
ANTENNA STABILIZER
ANTENNA WIRE
ANTENNA REEL
TERMINAL BOARD
½" O.D. CONDUIT OR SHIELDED WIRE
#10 WIRE
TAIL FEED OUT INSULATOR ASSEMBLY AND AUTOMATIC STOP SWITCH
BOWDEN CONDUIT (COVERED BY COPPER BRAID FOR BONDING REEL TO ANTENNA THRU SWITCH)
REVERSING RELAY
MULTI WAVE (COUNTER) CONTROL UNIT
Reel In
Reel Out
TO 12 VOLT BATTERY

Diagrammatic sketch showing assembly of Heintz & Kaufman motor-driven aircraft antenna reel

EQUIPMENT and METHODS

Welding Cycle Recorder

• A DEVICE for giving pictorial evidence of the length of time current flows in an alternating current circuit, is available from the General Electric Co. This cycle recorder is designed for use with resistance welder timers—in calibrating or adjusting these timers or as a means of producing a permanent record of weld times. By indicating when an accurate re-setting of welding time is attained, the device is useful in duplicating welds previously found satisfactory. The instrument not only records optimum welding time for a specific job as determined by experiment, but enables the production welding machines to be set to reproduce this time.

It records, on a renewable strip of thin paper, the cycles of current-flow duration. It is oscillographic in nature, but no attempt is made to have it follow wave form accurately. It consists of a unit 5½ in. × 7½ in. × 7½ in. containing a frequency-responsive element marking mechanism, paper-tape drive, and paper-tape supply.

The frequency-responsive element is a polarized reed driven by a coil which surrounds it. This driving coil is tapped for use at either 1- or 5-amp., although a 110-volt coil can be obtained if desired. The reed vibrates and follows the alterations of the current.

The recording device is inkless. A stylus carried by the vibrating reed presses on a moving strip of paper under which rotates a graphite roll, which also is renewable.

Emergency Carbide Light

• A CARBIDE emergency light, weighing 40 lbs., when fully charged, and which burns for 3 hours, giving 8000 cp. has been produced by National Carbide Sales Corp., New York, N. Y.

The reflector is mounted on a universal swing joint, so that the light may be shifted to any angle and may be folded down for carrying by a convenient handle above the carbide hopper. This unit is 42 in. high when extended for use, and 28 in. when folded.

A 1¾ lb. charge of carbide is sufficient for more than 3 hours service. The light may be operated intermittently, as needed, without waste of charge. By throwing a lever, the carbide is released a few grains at a time into the water tank below, and the rate of feed of the dry carbide is regulated automatically by the gas pressure. The light may be shut off by throwing the lever back to locked position. The tank is made of 18-in. gauge sheet steel, hot-dipped in lead after welding. There is no spilling if the light is overturned.

Rubberized Hair For Upholstery

• CURLED HAIR, encased in a coating of pure gum rubber which is vulcanized, is utilized in the construction of *Paratex* which is finding application in the industry for upholstering seats, backs, arm rests, crash pads, and for insulation.

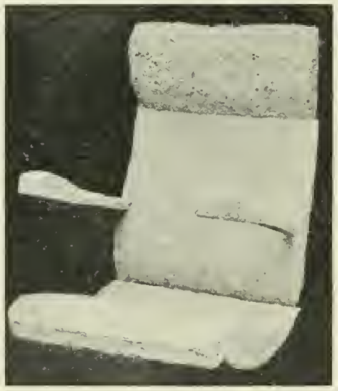
Manufactured by Blocksom & Co., Michigan City, Ind., the material comes in sheet or moulded forms, the latter being furnished to any desired size, shape or density.

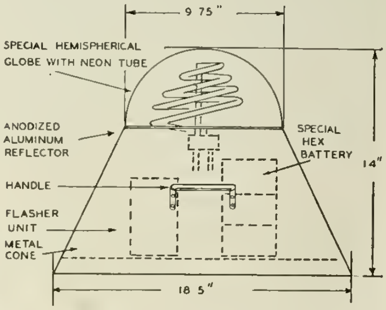
Featuring light weight, the moulded pads retain their original contour indefinitely since the rubberized curled hair springs back into place when it is freed from compression. Where cushions are subjected to severe usage, they are molded to size and shape with pockets for springs. Regular coil springs of the desired gauge are installed in these pockets and if additional support is required, border wires may also be molded in the pad where needed. Springs are prevented from slipping from place, breaking or thrusting through the top cover. When installing *Paratex,* it is only necessary to pull the cover over the pad and tack it to the frame.

Moulded Paratex chair for S-42

•

Type developed for Stinson




9 75"
SPECIAL HEMISPHERICAL GLOBE WITH NEON TUBE
ANODIZED ALUMINUM REFLECTOR
SPECIAL HEX BATTERY
14"
HANDLE
FLASHER UNIT
METAL CONE
18 5"

Rose-type marker designed for Newark airport

Airport and Airway Markers

• A PORTABLE airport and airway marker recently developed by Rose Aviation Corp., New York, N. Y., uses incandescent gaseous tubes for its light source, operates from three months to a year on a dry battery, and can be arranged to provide red, green and yellow light.

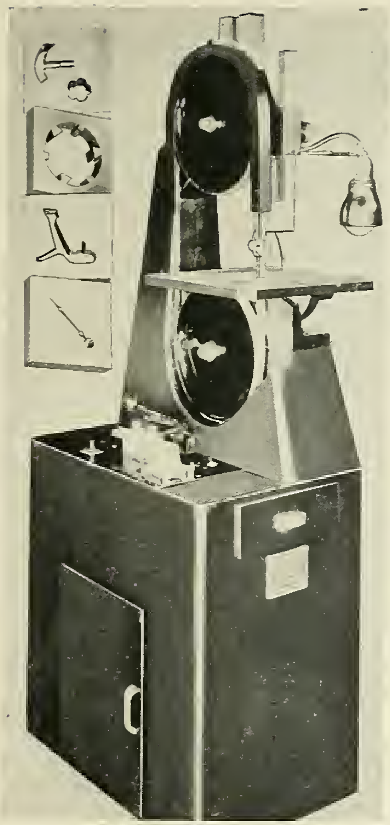
A new improved switch, requiring little energy, is effectively used as an interrupter contact in the primary circuit, giving a quick break and assuring a quick sharp flash. Flashing frequency is changeable, and can be made to suit most requirements, usually 3 to 4 flashes per second. Large pure silver contacts assure long service life.

The Rose-type markers are fitted with a prismatic magnifying lens, which diffuses the glow from the flashing tube, and at the same time a metal reflecting mirror mounted below the light source concentrates the light and increases visibility from any angle above the horizon. The diffusion from the prismatic lens prevents glare reflections on the plane's windshield.

The light is also adapted for use in wind cones, or for illuminating ground tees, corners of fields, buildings, etc., as the tubular light source can be shaped into various designs.

A larger unit, utilizing a combination of several of the smaller units, is being developed as an auxiliary airway beacon for use between the usual rotating flashing beacons, and to provide course lights.

The flexibility of the independent portable unit is a feature since it can be readily moved as boundaries or runways of a field are extended.



Combination Filing and Sawing Machine

• A DUAL purpose, combination band filing and band sawing machine has been developed by Continental Machine Specialties, Inc., Minneapolis. Known as the *Do-All,* the machine is adaptable for making special aircraft metal parts, being changeable from a filing to a sawing unit in a few minutes.

Inside sawing is accomplished by cutting the band saw blade, putting one end through a starting hole in the work, and then rewelding the saw blade in a self-contained automatic electric brazing device. Inside filing is done by uncoupling the file band at a point where a bayonet-type of joint is provided, and hooking the band together after it is inserted in the hole to be filed.

The machine makes possible a new way to cut holes out of metal. The old method was to drill a row of small holes and following a periphery just inside the layout line of the hole desired, then to hammer out the slug and file off the ragged radii left by the drills.

The file band is made up of 3-in. segments of files which are mounted on a flexible spring steel band. The flexible steel band runs over the pulleys, but the files remain straight. This file band will not stretch, and every inch of the file surface is used.

The machine does continuous, uninterrupted cutting in both its filing and sawing functions as compared with the jig saw type of filing and sawing machine or with hand filing and sawing.

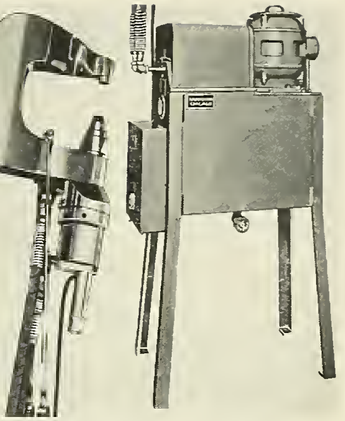
Portable Hydraulic Riveter

• A HYDRAULIC production riveting machine comprising a portable yoke-type hydraulic press and an automatic hydraulic pressure generator, connected by high-pressure hoses and electric control cable, is ready for distribution by Hannifin Manufacturing Co., Chicago.

The press weighs 54 lbs., and develops a maximum pressure of 35,000 lbs. to head the rivet. This capacity is ample for ⅜ in. cold iron rivets. The throat of the yoke is 6 in. × 6 in. and the ram stroke 3 in. Maximum pressure developed on the dies may be adjusted to suit the work.

Control of riveting operation is by a single push button at the top of the press handle. Depressing this button actuates the hydraulic pressure generating unit and its control valves, and the riveting cycle is automatically completed.

The generator is an automatic power unit, with electrically actuated valves and oil pump control. It is driven by a 2 h.p. motor, and the outside dimensions are 32 in. × 17 in. × 56 in. The hydraulic pressure generator provides large volume delivery at moderate pressure for rapid advance stroke of the press ram, an automatic step up to high pressure for the actual heading of the rivet, and an automatic reversal upon reaching maximum pressure, with rapid reverse stroke of the ram to starting position. The complete riveting cycle is 2.5 seconds per rivet.



Hannifin hydraulic riveter outfit

Light Weight Electrical Drill

• BLACK & DECKER Mfg. Co., Towson, Md., has developed the ½" Junior drill as companion to the ¼" Junior announced several months ago.

This new drill is adaptable to many drilling and cutting applications. It has a low spindle speed and powerful torque adapting it for cutting round holes in wood, sheet metal, cast iron and composition material. The drill is powered for drilling holes in steel up to ½" size; for driving wood augers up to 1¼" size. It is of light weight (10.5 lbs.) and uses a motor which operates on either alternating or direct current. Standard voltage is 110, but the drill can also be supplied for 32, 220, or 250 volts. It is furnished with Compo oil-less bearings, safety switch, 3-jaw chuck and key, spade handle and auxiliary pipe handle.

Hypressure Jenny being used to clean fuselages for inspection and overhauling, cleaning exteriors of planes, engines, etc.

Personairlities

by Caldwell

● WHEN JACK B. BARTOW was a lad with a peculiarly penetrating and annoying boy-soprano voice he used to sing in a choir. That is, he sang in it until they discovered what was the matter with that choir. One of his favorite hymns was that one about, "Let your lower lights be burning: send a gleam across the wave. Some poor struggling storm-tossed seaman, you may res-kew, you-u may sa-a-ave." So when he became a man the idea stuck with him, and he ended up by developing the Bartow Beacon, which beckons the wandering aviator home on dark and stormy nights. All of which goes to prove that if you lead a good life from early childhood that you may get somewhere by the time you're too old for it to do you much good.

Jack has always led a good life: he doesn't smoke, chew, or drink alcoholic beverages, which is a fine thing if you look at it one way and not such a fine thing if you look at it from the viewpoint of the Internal Revenue Department. Where would the country be, I'd like to know, if none of us smoked or drank and paid taxes for the privilege? The Treasury would be short over a billion dollars a year in taxes. I am happy to say that as a tax-payer I have smoked and drunk myself into a very warm spot in the heart of the tax-collector—that is, allowing that the tax-collector *has* a heart, which I sometimes doubt. Jack doesn't even drink tea or coffee; he drinks skimmed milk—ordinary milk is too strong for him. He's been that way from childhood, and it was freely predicted that he would either go far in life on this Spartan diet or else die of malnutrition. Oddly enough, he's quite strong. He visited me in July at my country estate, Fallen Arches, and we went swimming in the Atlantic. He battled the waves as nobly on his old skimmed milk as his friend Lewis Ziegler and I did on a few shots of something more substantial. But we probably felt better.

Jack Bartow was born June 24, 1897, at Forksville, Pa., and reached a high point in his career when he startled the aviation world by landing at the 1923 National Air Races at St. Louis flying a Thomas Morse Scout which rejoiced in the possession of one OX5 engine and one Ford wheel. With this somewhat unorthodox and unnerving combination he took second place in the stunting and fancy flying exhibition, and made the front page all over the country on account of that Ford wheel which he had bought to replace his original wheel damaged in a forced landing on his flight from Houston, Texas.

As a lad he built and flew model gliders, graduating to a 25-foot biplane glider originally built, flown, and crashed by Worl Holby. Bartow spent four years rebuilding, flying, and crashing that glider, averaging one rebuilding to each flight. This taught him the virtue of patience, which he gradually accumulated chunk by chunk until to-day he is one of the most patient men I know.

Jack B. Bartow

Eventually, there weren't enough pieces of that glider large enough to glue together so he joined the Pennsylvania Cavalry in 1916 and spent a year in the Mexican Border service. It was a bit monotonous down there, especially for a milk-drinker, so just to liven things up in 1917 his own horse kicked him into a nearby hospital. He recovered in time to go overseas with the 28th Division in the artillery, winning the Oversea bar with four stars.

Returning to the land of the Pilgrim's Pride he moved on to airplanes, enlisting as a private, U. S. Air Service, becoming a mechanic, and winning an appointment to the U. S. Flying Cadet School at Arcadia, Florida. In 1921 he received his wings and was commissioned in the Reserve Corps, which automatically forced him to make his own living until the next war. He survived by barnstorming in Texas, Arizona, New Mexico and old Mexico. In 1921 he was a member of the first aerial police department in the country, at San Antonio, Texas. He never caught anybody, though he and Bill Long did fly all around one day looking for a quartet of bandits who had robbed a bank near San Antonio before the president of the bank had a chance to do it himself. The bandits got away with $70,000 and the president has never forgiven himself for being so slow.

The old bandit hunter from Texas found the going very tough in aviation in 1921 and '22, so to keep body and soul together, as the saying goes, he became a dancing instructor. That goes to show the depths to which a great man can be reduced in this business. However, he pulled up out of that, threw away his dancing pumps, and barnstormed Pennsylvania, New York, and Ohio during 1924 and '25, operating a field at Clarion, Pa., in partnership with the late Parker Cramer. It was at Clarion, an emergency stop for air mail pilots on the Cleveland-Bellefonte run, that Bartow became interested in aviation lighting. He designed an all-weather beacon from which, after several years' patient study and experimenting, he has developed the present Bartow Beacon, described in the June, 1935 issue of Aero Digest. Apparently it is the last word in beacons. He is now working on a visual fog landing system and at the moment of writing is up at Cape Cod studying fog. I suggested to him that he go down to the Bureau of Air Commerce if he wants to study a fog that really is a fog.

Jack won considerable fame as a cross-country pilot. Taking delivery of a new Waco off the show floor at the 1930 Aircraft Show at Detroit, he started for

Cleveland, being advised to fly to the Detroit River, pick up Lake Erie, and follow the shore to Cleveland. He picked up the river, found the lake, and flew along its shores for an hour, arriving, to his amazement, back in Detroit. Upon landing there again and consulting a map, he discovered that he had just circumnavigated Lake St. Clair!

Leaving Clarion, Jack spent two years with the Bessemer Diesel Engine Co., and then developed the fuel control system used on the first radial Diesel to be built. Subsequently, he joined Ludington Flying Service, stayed two years, and in 1929 formed and operated Wings Corp'n, at Camden, N. J., Waco distributors, after which he built and managed Wings Field at Ambler, Pa., on which the Philadelphia Aviation Country Club now is located. He was a hound for punishment so he also formed a glider school in conjunction with flight training there and operated Wings Airline between Camden, Wings Field, and the Pocono Mountains. In his spare time he kept right on inventing, working 18 hours a day, on skimmed milk. Just imagine what he would have done on beer!

* * *

● IT WAS toward the end of the Jennie or Paleolithic Period in aviation, just before the early Waco, or Neolithic Period, that I first began to hear of that strange creature, the Busy Executive who would Fly his Own Plane to Save Time. I didn't believe there was any such animal. In the first place, I didn't see how anyone could save time in a Jennie; and in the second place I couldn't imagine that anyone smart enough to become a Busy Executive could also be dumb enough to sit and watch the rocker arms on an OX5 go up and down while he, the Jennie, and the OX ambled patiently over the countryside. In fact, for years and years that Busy Executive was one of our standard aviation myths—you used to hear about him, but you never actually saw him.

And then, almost imperceptibly, he began to materialize, like a spook at a spiritualist seance. One was seen down in Texas, an oil operator who had been in the Air Service, and who was flying his own plane around the oil fields. Another oil man had actually come to Wichita, so Clyde Cessna or Walter Beech told me back in 1923 or perhaps earlier, had learned to fly, and had bought a Swallow. He was executiving around in that and saving days, because the distances were long, and the train service in some parts only spasmodic. But in the East all the Busy Executives were using the *Twentieth Century* and the *Detroiter,* and traveling while they slept. Even the Executives who weren't busy still were too busy to spend all day in a crude and somewhat uncertain airplane going from New York to Chicago, or Cleveland.

Meanwhile the industry was getting into its stride and was turning out planes that even fairly sensible people could fly in without having their relatives suggest that they be examined by phrenologists for possible dents in the skull. So in course of time the Busy Executive actually was seen in the flesh—and in an airplane. And gradually the species began to increase, slowly at first, and then rapidly, until today many a business man uses his plane as casually as he uses his car, and actually saves time with it. Which leads me naturally to Mr. J. B. Walker, vice-president of Beaumont and Hohman advertising agency, who finds his plane a most necessary adjunct to his business. Calls on clients and prospects, and visits to the widely scattered offices of his company, have kept him in the air. An enthusiastic fisherman, he uses his plane for week-end jaunts into the North woods country, with wheat fields and pastures as landing fields.

J. B. Walker, the Flying Executive

For the benefit of doubting friends he carries and quotes—if they don't stop him—figures to show that it costs him less to operate his plane than they spend on a car, not to mention time saved in covering territory. He has even capitalized his interest in aviation, for his firm now handles the advertising for three airlines and one airplane manufacturer. His home port is the Aviation Country Club, Palwaukee Airport, on the outskirts of the city of Chicago.

J. B. Walker was born Aug. 23, 1898, at Fayetteville, Arkansas, and educated at the University of Arkansas. He got into the tail-end of the war in the last officers' training class at Camp Pike, Little Rock, Ark., but before he could get across the Germans had run out of liverwurst and weiner snitzel, and were fed up anyhow, so they didn't wait for him, but called it a day and went home, while young Walker returned to the University and continued sopping up an education. Filled up to the neck with Higher Learning, he went to the big city of Chicago and began his career as a cub copywriter at Montgomery Ward & Co., later called Monkey Ward in stock market parlance by the monkeys—and I was one of them!—who lost our shirts dabbling in the stock back in 1929.

Mr. Walker used to write up ads for that grand compendium of knowledge, the annual catalogue, so much in favor in rural libraries, and both the two- and four-holers. Mr. Walker has been a friend indeed to the farmers—far more of a friend than our Secretary of Agriculture, Wallace.

He became advertising manager of the Greyhound Management Co., operating the Greyhound Bus Lines, in 1928, moving up to vice-president in charge of traffic and advertising—a position which entailed considerable travel over the widespread territory served by the Greyhound Lines, usually by bus. He finally got so fed up with buses that he couldn't look one of the things in the rear axle, so in self defense he took to the airlines. But riding the lines in 1928 was no great catch either, with only one or at most two schedules a day in operation on most routes. So he decided that perhaps doing his own flying might save him a lot of valuable time.

His headquarters were in Cleveland, which rejoices in a fine Municipal Airport situated on the estate of Major Jack Berry, one of the local millionaires who had donated the land for the purpose. Or was it the city that had donated the land to Jack Berry? I've forgotten now. But no matter. The upshot was that Mr. Walker ended up by dropping in on the Sundorph Aeronautical Corp. for a trial flight. He liked it, being able to move the stick around and watch the machine side-slip and annoy the instructor, so he signed up for a course, and tried the patience of one Donald Patrick in a Warner-powered Bird until the day came for him to go solo and annoy nobody but himself.

Following some 12 hours' solo he applied for his private pilot's license, and took his tests in a radio equipped ship, with W. M. Robertson of the Department of Commerce at the microphone in the tower of the Administration Building—Castle Berry, as it is called by the natives of those parts. Newspaper men and photographers were on hand to record for posterity the first D of C test by radio direction—it was the first in Cleveland, anyhow. The tests went off well enough, and Mr. Walker was about through, when the engine also decided that it also was through, which it announced somewhat peevishly by hurling one cylinder into the air, to land on the cowling, and thence to bounce off and go through the lower right wing, and so on disconsolately to the ground.

Mr. Walker was somewhat non-plussed. Recalling his instructor's admonition

(*Continued on page* 71)

ACTIVITIES AT THE SCHOOLS

New Courses Opened

A COMPOSITE course in aeronautics given by men associated with aviation in Buffalo, N. Y., has opened in the University of Buffalo. G. Graham Davidson, chairman of the aviation committee of the Junior Chamber of Commerce, is course co-ordinator.

F. E. Loudy, E. R. Child, W. J. Blanchard and Alexander Tsongas, all of the Curtiss Aeroplane & Motor Corp., are instructors, as well as A. T. Lines of American Airlines, and Emil A. P. Raab of the Buffalo Airport.

Courses are given once a week, at night, in Townsend Hall, and are open to high school graduates or persons who have had practical aviation experience.

Announcement has been made by the Extension Division of the University of California, Berkeley, Calif., that their course in Diesel Engineering has been thoroughly revised and is now open. The course presents a general discussion of the elements of the Diesel engine so as to furnish the practical man with fundamental principles which will assist him in its operation and maintenance.

Two new courses have been added in the aviation division of the School of Education, New York University. Trips to aviation schools and a study of the teaching methods and devices used in secondary aeronautical education in the United States, Russia and European countries will be made in the course. Roland H. Spaulding who recently returned from a tour of Russia and other European countries will give the course.

The other new course, *Airplane Engines and Engine Instructions,* will include work in the study of the principles of the internal-combustion engine, their maintenance, and methods of teaching employed by instructors in this subject.

Enrollments Continue

STEADILY INCREASING enrollments at schools throughout the country is evidenced in reports from various schools. The Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal, Glendale, Calif., enrolled 27 new students in September, thus topping July, the former record month.

Parks Air College reports new student enrollments of 92 for the Fall term, making a total of 252 resident students as compared with 197 in the Fall of 1934. Of the 92 new enrollments, all but 11 were for the two-year courses. The increase in resident students has necessitated the construction of a fourth dormitory on the campus.

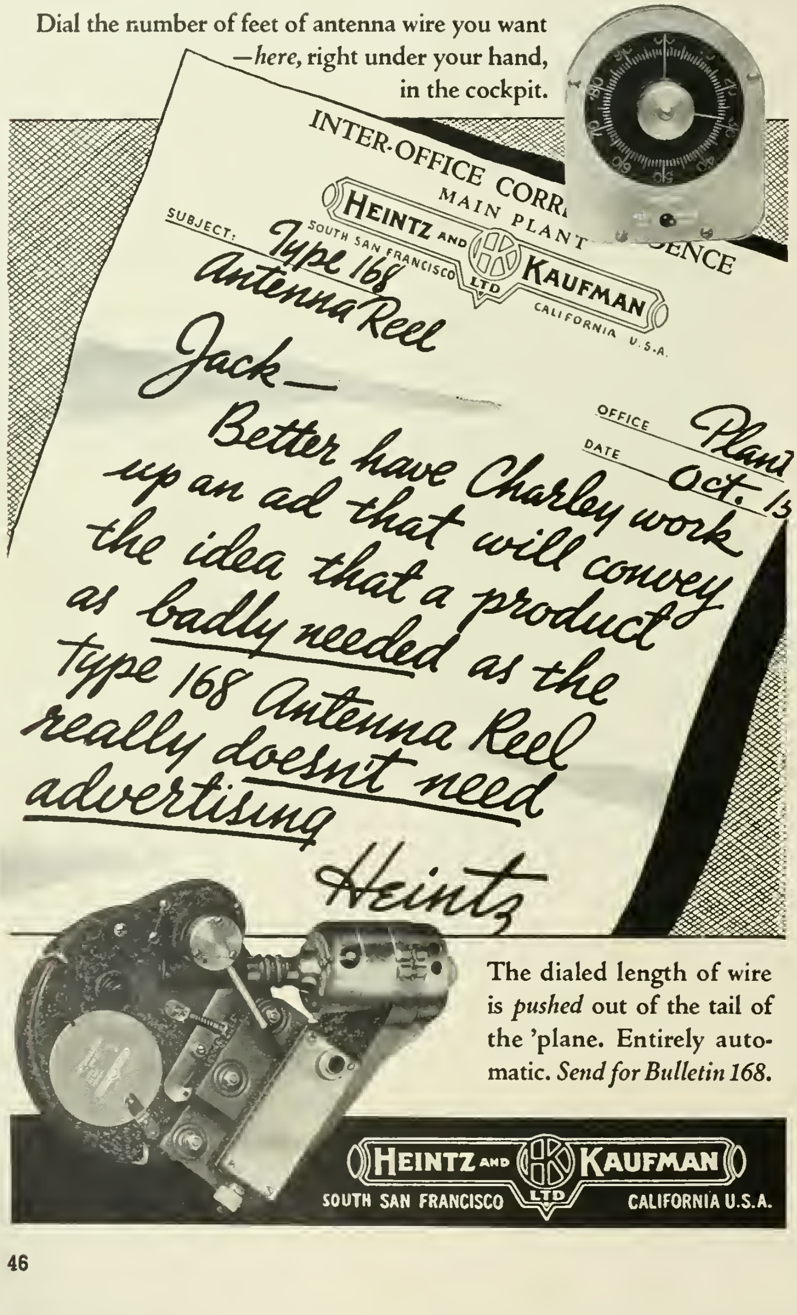
Beginning the fall and winter influx, 18 new students reported for training at the Ryan School of Aeronautics, and the New England Aircraft School, Boston, Mass., reported that seven students enrolled in the day mechanics' class. Evening courses are also filling better than in several years.

More than 60 students were enrolled recently at the Dallas Aviation School, Dallas, Tex. The school has completed a new steel hangar, which brings the total space for school operations there to 55,000 square feet, and is now celebrating the ninth year of its existence.

Ryan Buying Equipment

ADDITIONAL GROUND school equipment will be installed in the enlarged quarters of the Ryan School of Aeronautics according to T. Claude Ryan, school president, who anticipates a larger enrollment at his San Diego School this winter than ever before.

The new building, which is located adjacent to the Ryan aircraft factory will house the drafting, welding, engine, and rigging departments.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PRIVATE FLYING AND CLUB NEWS

Club Activities

AT AN election held at the Casey Jones School of Aeronautics, Newark, N. J., for new officers for the Aeronautical Engineering Society, C. E. Sigler was chosen president; Len Bayer, vice-president; Nicholas La Costa, secretary, and Alvin Vander Byl, treasurer.

Headquarters for the Air Travelers Club of America, Inc., will be opened in a midtown hotel in New York City, according to B. Palmer Davidson, president of the club. The group was recently organized and its headquarters will be a source of interesting facts and educational information on air travel.

Women's Races Planned

UNDER THE sponsorship of the Long Beach, Calif. Junior Chamber of Commerce, the Women's Championship Air Races and Pacific Air Pageant will be held Nov. 10 and 11 to determine the champion woman flier of the United States. The event has the sanction of the National Aeronautic Association.

The chief competitive event is a transcontinental dash from Floyd Bennett Field, New York to the Long Beach Municipal Airport. There will be three other races, over closed courses and open only to women fliers.

Five thousand dollars will be divided among the first four finishers in the transcontinental dash and three other purses totaling $1800 will be awarded in the closed course races.

Gladys O'Donnell is managing director of the races and she is being assisted by Orville A. Kuster, general manager. Thus far Laura Ingalls, Jacqueline Cochran, Marie Bowman and Henrietta Lentz are entered. More than a hundred of the country's best-known women pilots have been invited to compete.

50,000 See Akron Air Show

A CROWD of 50,000 spectators massed at the Akron municipal airport to see the first annual Akron *Times Press* Air Show featuring the flying of Major Al Williams, Lieut. Joe Mackey, Gordon Mougey, and Marine flyers from Detroit, Mich. Irvin Davis made a bat-wing parachute jump.

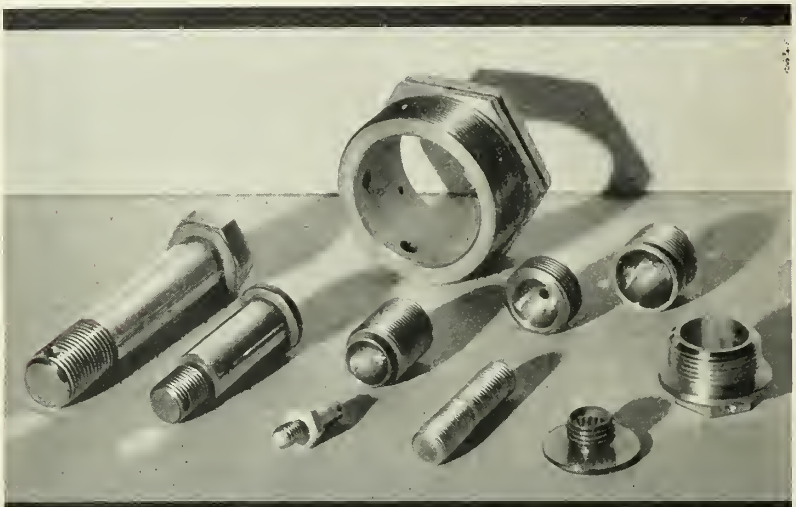
A crowd of similar size saw the same group perform at an air show at the Moline, Ill., municipal airport in honor of Harold E. Neumann.

Nearly 8,000 people witnessed an air show at the Circleville airport sponsored by the Circleville, O., chapter of the National Aeronautic Association. Army planes from the 308th Observation Squadron at Port Columbus participated in the annual aviation day program.

112 Planes In Two Tours

THIRTY-FIVE pilots and passengers, flying in a dozen planes, made a two day tour of the state of Arkansas, Oct. 12 and 13, visiting seven cities in the eastern section of the state. An overnight stop was made at Memphis, and other fields visited were Stuttgart, Monticello, Portland, Helena, Blytheville, Hughes and Brinkley.

With almost 100 airplanes visiting major cities of Pennsylvania, the Keystone State has made its second annual good-will tour. Special features, including the presence of Governor George Earle in his autogiro added interest to this year's flight. Many industries participated in the celebration, including the Gulf Refining Co., which supplied gasoline for every pilot in the tour. The group took off from Harrisburg and visited Johnstown, Pittsburgh, Meadville, Erie, Kylertown, Williamsport, Sunbury, Bloomsburg, Wilkes-Barre, Scranton, Allentown, Lancaster and Philadelphia, where the tour ended.



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AIRLINES AND AIR TRAVEL

Airlines Set New Safety Record

SCHEDULED AIRLINES set new safety records by flying 990,660 miles per accident and 40,714,686 passenger miles per passenger fatality in the first half of 1935, according to the Bureau of Air Commerce.

Air transport craft, which flew 28,729,128 miles, were involved in 29 accidents in the first half of 1935, and only once before had the number of accidents in a six-month period been less. That was in the first half of 1934 when there were 27 in 21,517,658 miles flown.

There were 5 fatal accidents, in which 4 passengers lost their lives. Of previous six months periods for which statistics are available, three had fewer than 4 passenger fatalities, eleven had more.

The new high for passenger miles flown per passenger fatality (40,714,686 for the first six months of 1935) is more than three times as great as the average for the last five years. Previous high in this category was 38,321,196 in the first half of 1933. In the last half of 1934 it was 26,339,197.

Causes of accidents in percentages were as follows: Personnel errors, 38.27; power plant failures, 13.8; airplane failures, 10.35; weather, 20.34; airport and terrain, 13.79; undetermined and doubtful, 3.45.

Foreign Mail Contract Rates Lowered

AGREEMENTS HAVE been reached between the Post Office Department and Pan American Airways and between the Department and Pan American-Grace Airways, Inc., which will result in an annual saving to the Government of approximately one million dollars, as compared with the mail pay to these companies on July 11, 1934.

Rate reductions agreed upon by Pan American Airways are as follows: On the routes between Miami and Paramaribo, between Miami and the Canal Zone, between Havana and Belize, between San Salvador and the Canal Zone, and between the Canal Zone and Port of Spain, the rate of pay for service performed by land planes and twin-engine marine aircraft will be reduced from an average of $2 per mile to an average of $1.80 per mile. When new four-engine flying boats are put into service between Miami and Paramaribo, and between Miami and the Canal Zone, there will be no reduction in the present rates. On the route from Miami to Nassau the contract rate is reduced from $2 per mile to $1.25 per mile.

Rate reductions agreed upon by Pan American-Grace Airways cover the route between Cristobal and Montevideo. These effect a reduction of from an average of $1.70 to an average of $1.50 per mile.

Pan American's bid of $2 per mile for the specified load of 800 lbs., on the trans-Pacific route, however, was accepted by the Post Office Department. The new service will be on a weekly basis.

Personnel Changes

ARTHUR KINGHAM, former manager of the Stillwater, Okla., airport, recently took up co-pilot duties with TWA, Inc. For several months, Kingham was assigned to regular army duty at Barksdale field, Shreveport, La., but he resigned to enter the commercial field.

Charles Renouf has been transferred to Chicago to participate in general traffic work for Eastern Air Lines, according to John C. Graves, division traffic manager. New Lockheed *Electras* will be used on the New York-New Orleans flights, for use in local service to supplement the Douglas planes.

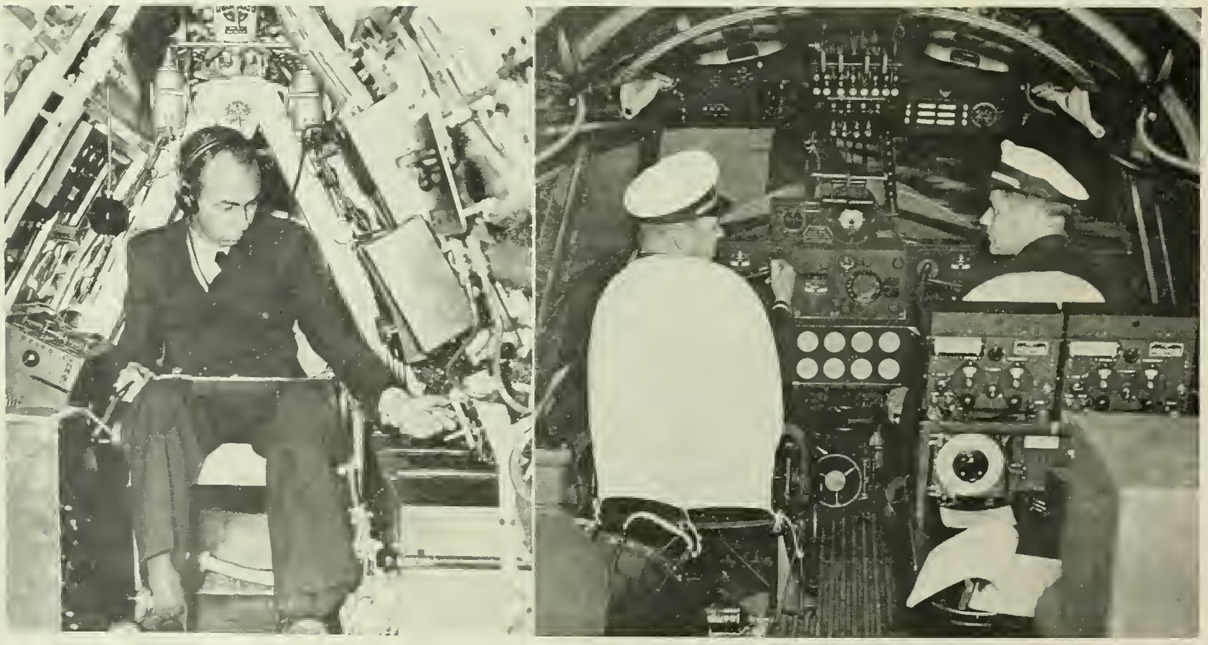
William M. Gage has been appointed Canadian traffic representative for Northwest Airlines, according to F. J. Bixler, Chicago traffic manager. Gage has opened offices in Winnipeg to handle business for the Fargo-Winnipeg route.

Boston's initial step toward an eventual consolidated air ticket office was made recently with the arrival there of A. W. French who will act as New England representative for both Pan American Airways and Eastern Air Lines.

Airlines Employ 197 Hostesses

AIRLINES IN the United States employ 197 women as hostesses, according to reports from the airlines to the Bureau of Air Commerce. Seven domestic airlines have hostesses on their craft, including American Airlines, Braniff Airways, Columbia Airlines, Hanford Airlines, TWA, Inc., United Air Lines and Western Air Express.

(*Continued on following page*)



Acme photos

Arrangement of flight engineer's deck (left) and pilots' compartment in the Martin Clipper Ship for Pan American Airways

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LICON AIRWAYS
Islip, N. Y.
LONG AND HARMAN AIRLINES, Dallas, Texas
NATIONAL AIR LINE SYSTEM, Chicago, Ill.
NATIONAL AIRWAYS
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NEW YORK AIRWAYS
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PACIFIC SEABOARD AIR LINES, Memphis, Tenn.
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RAPID AIR LINES
Omaha, Neb.
REED AIRLINES
Lawton, Okla.
ROBERTSON AIRPLANE SERVICE COMPANY
Robertson, Mo.
SALT LAKE - GREAT FALLS AIRLINE, Salt Lake City, Utah
TRANSCONTINENTAL & WESTERN AIR
Kansas City, Mo.
UNITED AIR LINES
Chicago, Ill.
LINEAS AEREAS OCCIDENTALES, S. A.
(Western Air Lines)
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WEDELL-WILLIAMS AIR SERVICE, New Orleans, La.
WYOMING AIR SERVICE
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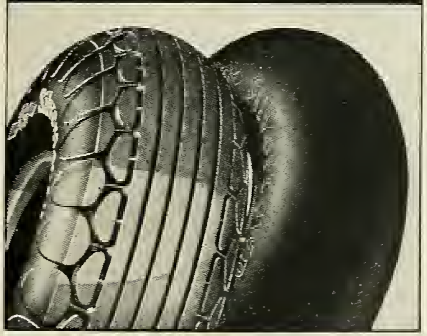

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(*Continued from preceding page*)

Delta Buys Electras

A FLEET of all-metal ten-passenger Lockheed *Electra* transport planes will be placed in operation over Delta Air Lines on all schedules between Atlanta and Dallas immediately upon delivery, it was announced by Laigh C. Parker, general traffic manager of the system. The new planes have a cruising speed of 182 m.p.h. and top speed of 206 m.p.h.

With all of its fifty airplanes converted to the standard of the 1935 type twin-engined Boeings with a top speed of 202 m.p.h. and cruising 189 m.p.h., United Air Lines has completed expenditure of $1,000,000 to speed up its equipment and is now flying its entire system with the newer type equipment, president W. A. Patterson announced. Repowering of the planes with 550 h.p. supercharged P. & W. Wasp engines with new Hamilton-Standard three-bladed propellers added 19 m.p.h. to the cruising speed.

Schedule Revisions

ON THE program of expansion for Northwest Airlines at Spokane next year, according to C. A. DuRose, traffic representative, are three daily flights each way between Seattle, Spokane, and the Twin Cities, instead of two a day, as at present. DuRose pointed out that much business was lost this year through lack of space aboard the Northwest Airlines planes, which have been operating at capacity, and more are required, with the more frequent trips to be inaugurated.

Chicago & Southern Air Lines has revised southbound schedules. Flight No. 1 now leaves Chicago at 9 a.m., and arrives in St. Louis at 11:40 a.m., with the stops at Peoria and Springfield eliminated. This plane will arrive in Memphis at 2:30 p.m., and in New Orleans at 6:50 p.m. Flight No. 3 leaves Chicago at 8 p.m. and arrives at St. Louis at 11:05 p.m.

Indicative of its expectation of heavier autumn travel than ever before, United Air Lines' new fall schedules call for 1,400,000 miles of scheduled flying monthly, only 100,000 miles less than the peak months' service of the summer. Although October 1 generally has signalized a substantial decrease in frequency of schedules, United will maintain full summer service of ten round-trip flights between Chicago and New York and three coast-to-coast schedules between New York and Pacific Coast points with two additional daily round-trip services between Chicago and Salt Lake City. Service between Chicago and New York was speeded up to 4 hours 15 minutes on trips making one stop at Cleveland. Faster schedules were inaugurated October 1 on the Pacific Coast airway when all trips were equipped with Boeing 1935 model 247-D transports.

A new schedule was inaugurated by Braniff Airways, flying between Dallas and San Antonio and return. Called the Legislative Special, the southbound plane leaves Dallas at 8:35 a.m. and arrives in Austin at 10:40 a.m. Returning, the plane leaves Austin at 2:15 p.m., arriving in Dallas at 4 p.m. The new schedule eliminates the Electra evening schedule from Dallas to Houston. The company also cut its flying time from Chicago to San Antonio by 3 hours 5 minutes by starting Electra service.

Effective on or about October 15, 1935, Vero Beach and West Palm Beach, Florida, were to be embraced as stops on route AM 6, the Newark to Miami route operated by Eastern Air Lines, and on October 1, the company revised its New York-New Orleans service flying two trips with Lockheed *Electras,* thereby cutting approximately 3 hours from the former operation of these flights. The Douglas schedule from New York to New Orleans remains the same, but an adjustment for the Douglas flight from New Orleans to New York provides more satisfactory service to all cities along the line.

Passenger, mail and express service to and from Bar Harbor on the lines of Boston-Maine Airways were discontinued for the season, effective with the 2.45 p.m. trip out of Bar Harbor, October 31, it was announced by D. C. Douglass, president. The tri-motored Stinson transports will continue to operate throughout the winter, however, on the regular run between Boston, Portland, Augusta, Waterville, and Bangor.

Braniff Installing Radio Unit

ANOTHER LINK in the chain of airways communication from the Great Lakes to the Gulf is being completed by Braniff Airways which is installing additional radio equipment at the Wichita, Kan., municipal airport. The new two-way short wave radio set, with 125 watt power, has a range of 2,000 miles.

The new station is being installed by F. C. Dyer and H. Daane, Braniff radio technicians. The station will use a 50-ft. mast and will be placed southwest of the terrace of the administration building, with the antenna strung between the mast and the roof of the administration building. The necessary additional space at the airport was granted by the Wichita park board.

New Ticket Office Opened

ESTABLISHMENT OF a traffic office in Minneapolis to serve the Twin Cities area has been announced by Charles A. Rheinstrom, general traffic manager of American Airlines. The office will be located at 95 South 7th Street and will be under the supervision of G. H. Hawes, Jr.

Hawes will be in charge of all sales solicitation and agent contacts in both Minneapolis and St. Paul as well as other nearby Minnesota cities.

August Passengers Total 97,715

ALMOST EVERY category in air transportation reached an all-time high during August when totals in the number of passengers, passenger miles, express poundage, and miles scheduled attained marks never reached previously in a single month. With 97,715 passengers flown during the month, the total for the first eight months was 557,820, almost the total for the full year 1934.

Passenger miles were 40,133,601; express poundage 551,886 and miles scheduled 6,143,560. For the first eight months, corresponding figures show 238,214,653 miles, 3,119,604 pounds, and 41,133,349 miles. Mail poundage for August was 1,245,929, and for the eight months 8,513,801.

Continued increases are expected in the light of a report for September from American Airlines. During that month 17,955 passengers were flown, this figure being more than twice that of September, 1934. This company's report out of Dallas for the first nine months of 1935 showed a passenger increase of 348 percent and a revenue increase of 429 percent. A total of 3181 passengers boarded its planes at that city, and this actively resulted in a new traffic record for Love Field, according to W. L. Williams, field director. The World Series brought more than 1000 passengers between Chicago and Detroit, necessitating the operation of 128 trips, 44 more than under normal conditions.

Passenger arrivals and departures at Lambert-St. Louis Municipal Airport, St. Louis, Mo., in the past fiscal year show an increase of 50 percent over the preceding year. The past year, compared with the previous year, shows a gain of 33 percent in air mail dispatched, and 250 percent in air express shipped from the airport. Passenger traffic in the three summer months registered a striking gain over the corresponding period of 1934, when arrivals in the months of June, July and August, 1935, totaled 2493 as against 1458 in 1934. Passenger departures in the past summer totaled 2445 as compared with 1532 in 1934.

Averaging approximately 20,000 revenue passengers per month during the summer season, United Air Lines scored a new world's record by transporting 78,687 passengers from June to September inclusive for an average of 19,672 passengers per month. The peak was reached during August when 21,122 passengers were carried, an international record for any airline during a single month. In June, United planes carried 18,557 passengers, in July 20,341 and in September, 18,667. The four-month total represents an increase of approximately 32 percent over the corresponding four months of 1934 when 59,512 passengers were carried.

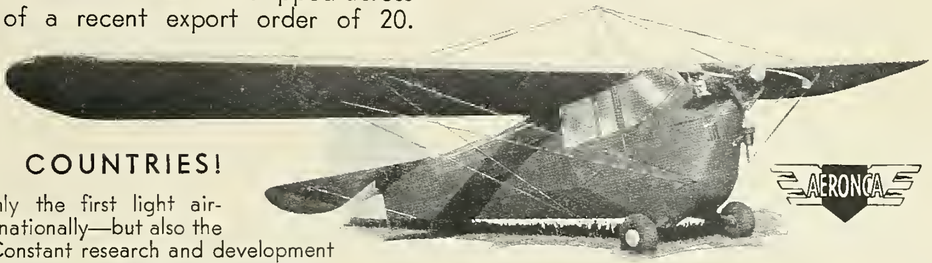
Can you answer these 6 questions?

1. Which was the first light airplane in America?
2. Which was the first American light airplane in England?
3.–The first in Canada?
4.–The first in Cuba?
5.–The first in Mexico?
6.–The first in South America?

TO ALL SIX QUESTIONS THERE'S ONLY ONE ANSWER

THE AERONCA!

This photograph shows the first Aeronca shipped across the Atlantic out of a recent export order of 20.



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THE AIR SERVICES

Hickam Field Plans Completed

PLANS FOR Hickam Field, to have an area of more than 2,500 acres, and ultimately to cost more than $5,000,000, were recently approved by Major-General Hugh A. Drum.

The immediate construction of the airport which is near Fort Kamehameha, Hawaii, will involve four double hangars, one operations hangar, water, sewer and roads systems, and construction of one runway.

Upon its completion, the field will contain quarters for about 180 officers, 175 non-commissioned officers, and barracks for 1600 enlisted men. Four additional double hangars will be constructed as soon as funds become available; also a machine shop and the necessary warehouses.

It is expected that approximately two and one-half years will be consumed in the construction of the field. The officers' quarters will be of the latest individual bungalow type and constructed to meet the climatic conditions of the Hawaiian Islands. Barracks and hangars will be of the latest design. The layout of Hickam Field will include broad boulevards, sidewalks, street lighting system, telephone system, fire department, public school and the utilities and facilities comprising a modern progressive community. The entire project will be modern in every respect, embodying all of the latest features and equipment.

Landscape gardeners are already at work on the site cultivating shrubs, plants and trees. There will be more than 20 miles of paved roads, with tree-lined boulevards affording direct communication and vistas to focal points around the surrounding territory.

The barracks for the enlisted men will contain lounging and reading rooms, a modern dining room with cafeteria service, and an up-to-date kitchen. The Depot will include large steel and concrete buildings, consisting of shops for major overhauling airplanes, and buildings for warehousing facilities.

The accompanying plan shows the various projects to be included in the construction of Hickam Field in which 1, indicates the Post Headquarters; 2, Post Exchange; 3, Post Theatre; 4, Post Infirmary; 5, Post Schools; 6, Wing Operations Office; 7, Double Hangars; 8, Post Fire Station; 9, Repair Shops, Engineering Shops, Equipment Repair; 10, Entrance Gate; 11, Officers' Club, with Bath House and Tennis Courts; 12, Quarters of Post Commander; 13, Bachelor Officers' Quarters facing water tank with Incinerator in rear; 14, Service Club; 15, Engine Testing Shop; 16, Sales Store, Ice Plant; 17, Supply Warehouse; 18, Garage; 19, Equipment Repair; 20, Engineering Shop; 21, Dope Shop; 22, Salvage; 23, Q. M. Warehouse; 24, Service Hangar; 25, Laundry; 26, Ordnance and Signal; 27, Tennis Courts; 28, Tanks; 29, Parking; 30, Bath House; 31, Incinerator; 32, Parade Ground.

Major Don L. Hutchins, Air Corps, and Capt. Howard B. Nurse, Quartermaster Corps are supervising the construction of Hickam Field, which was named in memory of Lieut. Col. Horace M. Hickam.

Capt. Gimmler Wins Mitchell Trophy

AVERAGING 212.9 m.p.h. for the 100-mile course, Capt. Karl E. Gimmler won the Mitchell Trophy from a field of nine Army pilots who competed at Selfridge Field. Lieut. J. V. Crabb was second at 211.9 m.p.h. and Maj. W. A. Maxwell took third at 211.4 m.p.h.

Lieut. G. A. Hatcher broke the course speed record and won the Junior Birdman Trophy by flying 240.38 m.p.h. over the mile straightaway. The Curtiss-Wright Trophy went to Lieut. C. B. Harvin with an average of 190.41 m.p.h. The races drew a crowd of about 55,000 persons, including General Frank M. Andrews, Brig. Gen. W. E. Mitchell, Col. E. V. Rickenbacker and Brig. Gen. Oscar Westover.

Sixty New Planes Expected for Navy

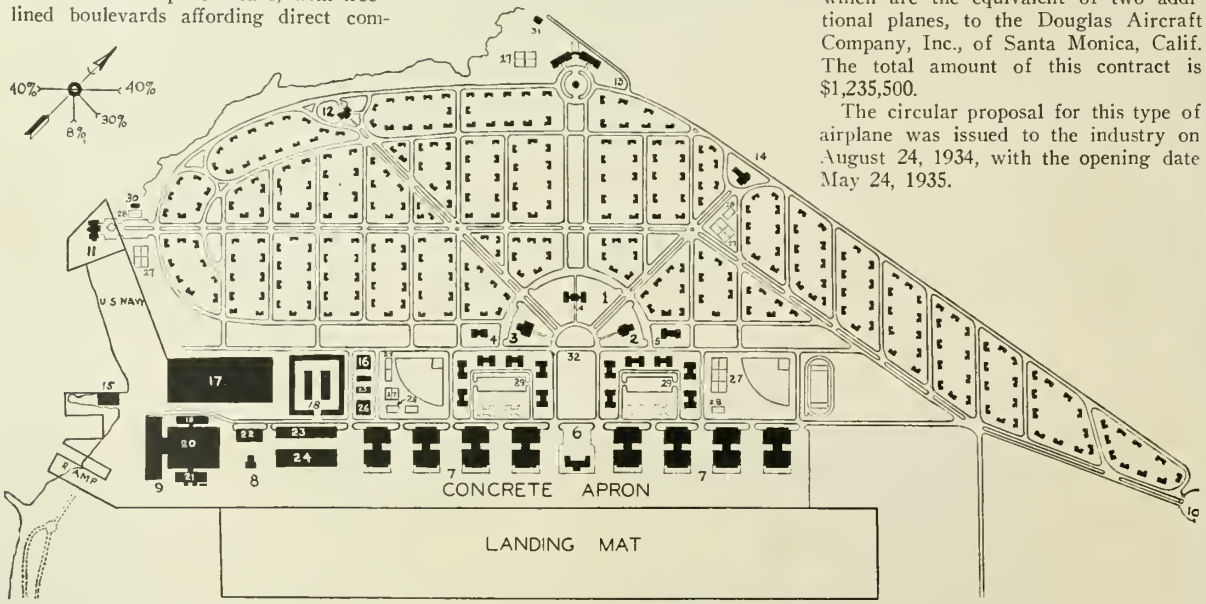
FOLLOWING A conference with Admiral Joseph M. Reeves, commander-in-chief of the fleet, Rear Admiral Ernest J. King, chief of the Bureau of Aeronautics, announced that the Navy will soon purchase 60 flying boats as the first step in reaching the 555-plane goal set for the Navy under a new program for which $26,000,000 has been voted by Congress.

The planes will be of the Consolidated XP3Y-1 type, one of which broke the world's non-stop flight record last month.

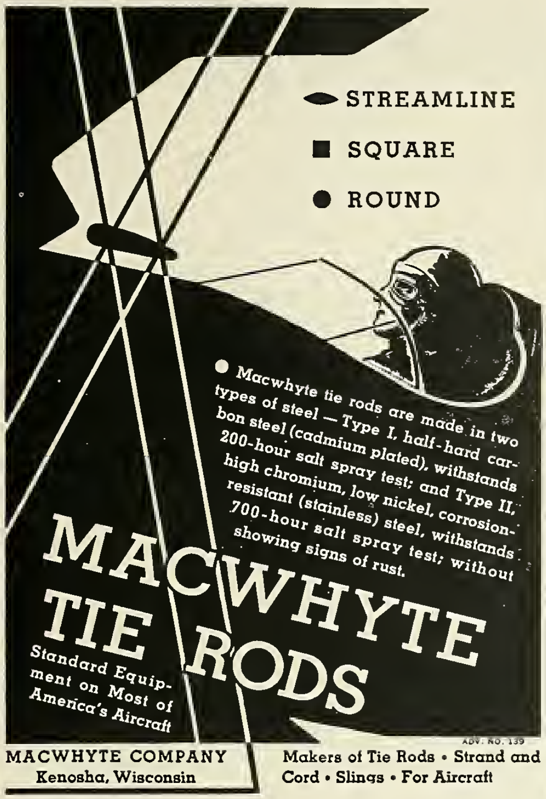
Army Buys 18 Douglas Transports

THE ASSISTANT Secretary of War, Harry H. Woodring, has announced the award for the procurement of 18 twin-engine transport planes and spare parts which are the equivalent of two additional planes, to the Douglas Aircraft Company, Inc., of Santa Monica, Calif. The total amount of this contract is $1,235,500.

The circular proposal for this type of airplane was issued to the industry on August 24, 1934, with the opening date May 24, 1935.



Layout of proposed airport for Hickam Field, the new Air Corps base near Fort Kamehameha, Hawaii



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STATEMENT OF OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

of Aero Digest, published monthly at New York, N. Y., for October 1, 1935.

State of New York, }
County of New York, } ss.:

Before me, a Notary Public in and for the State and County aforesaid, personally appeared Frank A. Tichenor, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Aero Digest, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Aeronautical Digest Publishing Corp., 515 Madison Avenue, New York, N. Y.; Editor, George F. McLaughlin, 515 Madison Avenue, New York, N. Y.; Managing Editor, None; Business Manager, Frank A. Tichenor, 515 Madison Avenue, New York, N. Y.

2. That the owners are: The Aeronautical Digest Publishing Corp., 515 Madison Avenue, New York, N. Y.; Frank A. Tichenor, 515 Madison Avenue, New York, N. Y.; Jessie H. Tichenor, 515 Madison Avenue, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) FRANK A. TICHENOR.

Sworn to and subscribed before me this 20th day of September, 1935.

(Signed) H. F. Koster, Notary Public,
Kings Co. Clerk's No. 82; New York Co. Clerk's No. 278.
(My Commission expires March 30, 1936.)

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By ORVILLE ADAMS, Consulting Diesel Engineer

THIS book was written with the purpose of combining in one volume, a text for study and reference—and a practical manual on operation and repair. Every fundamental basic fact requisite for understanding Diesel Engine theory and operation of all types, as well as rules for maintenance and repair are found in this book, arranged in a logical order, and written in easily understood language for the practical man. Information never before available is included in this new book. THE MODERN PACKARD AIRCRAFT DIESEL ENGINE IS FULLY DESCRIBED. 650 pages, 400 illustrations, $6.00.

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AT THE AIRPORTS

Development Personnel Appointed

APPOINTMENT OF seven regional supervisors and 13 district advisers for airport development work was announced by Eugene L. Vidal, Director of Air Commerce. The supervisors and advisers were appointed by the Bureau of Air Commerce, Department of Commerce, to assist field men of the WPA in passing upon applications for Federal assistance in the construction or improvement of airports.

The Bureau will view proposals from the technical and aeronautical points of view, advising as to whether proposed sites are suitable, and whether the work which cities desire to undertake will result in the establishment of landing areas and other facilities which will be suitable and desirable.

These men will be available for consultation with city officials, and will aid municipalities in planning programs along lines acceptable from the aeronautical standpoint. Their approval will be necessary before any proposed airport project will be accepted under WPA.

The Bureau's phase of the program is under the general direction of John S. Wynn, who is chief of the permanent Airport, Marking and Mapping Section. Paul Meyers, who is Assistant Chief for airport projects, will supervise Region 1.

The three district advisers for Region 1 are H. F. Law, adviser for Maine, New Hampshire, Vermont and Massachusetts, with headquarters at Boston; W. H. Hooker, adviser for New York, New Jersey, Connecticut and Rhode Island, with headquarters at New York City; D. H. Reed for Pennsylvania, Maryland and Delaware, with headquarters at Harrisburg, Pa.

In Region No. 2, the supervisor is C. E. Cox, Indianapolis, Ind. District advisers are D. W. Alexander for West Virginia, Ohio and Kentucky with headquarters at Columbus, Ohio. Other districts are Wisconsin and Illinois, with headquarters at Chicago and Indiana and Michigan with headquarters at Indianapolis.

For Region No. 3, E. M. Haight, Ft. Meyers Beach, Fla., is supervisor. Advisers are T. Miller for Virginia, North Carolina and South Carolina, with headquarters at Columbia, S. C.; Algene Key for Tennessee, Mississippi and Alabama, with headquarters at Jackson, Miss.; P. Moore for Georgia and Florida, with headquarters at Atlanta, Ga.

Region No. 4 is headed by Fred F. Grieme, Wichita, Kans. as supervisor. Advisers are A. F. Lytle for North Dakota, South Dakota and Nebraska, with headquarters at Pierre, S. Dak.; and R. S. Miller for Iowa, Minnesota and Kansas, with headquarters at St. Paul, Minn.

In Region No. 5, the supervisor is M. Patterson, Oklahoma City, Okla. W. J. MacKenzie, adviser for Oklahoma and Texas with headquarters at San Antonio, Tex.; and the region also includes another district comprising Missouri, Arkansas and Louisiana, with headquarters at Jefferson City, Mo.

For Region No. 6, the supervisor is J. E. Garn, Richfield, Utah. J. H. McKenney is adviser for Colorado, New Mexico and Arizona, with headquarters at Santa Fe, New Mex., and another district is comprised of Wyoming, Montana, and Utah, with headquarters at Helena, Mont.

Region No. 7 is headed by B. M. Doolin as supervisor. Advisers are R. L. Campbell for California and Nevada with headquarters at San Francisco, Calif., and E. Whitehead for Oregon, Washington, Idaho and Alaska, with headquarters at Seattle, Wash.

Repair Station Approved

AMES AIRCRAFT Corp., of the Boston Municipal Airport, East Boston, Mass., has been awarded an approved repair station certificate for repair of propellers and instruments, by the Bureau of Air Commerce, Department of Commerce.

Radio Station Building at Waynoka

BY JANUARY 1, Waynoka, Okla., will have a $56,000 modern government radio station. Work has already been started on the project. The station will include 16 60-ft. poles, 350 ft. apart, and the abandoned hangar there will be remodeled into headquarters for the radio crew.

New Airports

LOGAN, W. VA., dedicated its new $40,000 municipal airport with an estimated crowd of 10,000 attending. The airport, constructed with PWA funds, is located on the state route between Logan and Huntington. It is 2,000 ft. long and 600 ft. wide, has three all-weather runways, and ample hangar space.

The cities of Johnson City, Kingsport and Bristol in Tennessee are cooperating in the promotion of a joint airport. A committee has been appointed, with representatives from each of the three towns to arrange for the purchase of a site. The field is expected to cost about $50,000.

Socony-Vacuum at Port Columbus

CONTRACT FOR servicing Port Columbus, Columbus, Ohio, has been taken over by the Socony-Vacuum Oil Co., Inc., which has installed new Aero Mobiloil and mobile equipment there.

WPA Program Progressing

THE GOVERNMENT, under the Works Progress Administration, is planning to spend $50,000,000 for new airports and improvements to existing airports, according to a new expansion program now taking shape in Washington and under which $15,000,000 already has been appropriated and approved for 146 airport projects.

To date the largest single allotment was $3,043,120 for reclamation of San Francisco Bay for a municipal airport. The City of New York received $1,625,507 for completing Floyd Bennett Field, $3,000,000 went to Newark Airport, and $1,240,271 for the Los Angeles Municipal Airport.

Initial efforts under the program will be directed toward improving the facilities of airports along the principal airways, and a secondary consideration will be the building of ports in cities of 10,000 or more population.

Major Fred L. Smith, Ohio State Director of Aeronautics, says plans have been submitted to WPA at Washington for improvements costing between $2,500,000 and $3,000,000 at the state's principal airports. The largest improvement is planned for Cleveland, where an appropriation of $1,390,000 is sought for constructing macadam runways. An allotment of $175,000 is sought for similar purposes at Columbus, while varied amounts have been requested for the same purpose at Akron, Cambridge, Findlay and Mansfield.

Applications for Federal funds with which to build a $75,000 airport administration building at Love Field have been filed by the city of Dallas, and an appropriation of $5000 to purchase equipment for a radio approach system at Lambert-St. Louis Municipal Airport, St. Louis, Mo., has been approved by the Municipal government. Another appropriation of $1500 has been provided to buy materials for a concrete automobile parking area and a one-quarter mile road leading from the main highway to the air terminal.

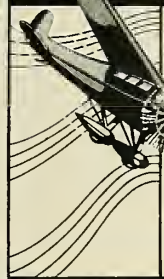
Personnel Changes

LT. WALTER M. BLAKE, has been named operations manager and chief pilot of the Madison, Wisc., airport, and James E. Keller has been named manager and placed in charge of sales there.

Gardner W. Stevens, owner of the Airport Inn, and a transport pilot at Brinkley, Ark., has been made manager of Cone Field, the municipal airport.

Lincoln Port Shows Profit

RECEIPTS FROM the Lincoln, Neb., municipal airport have increased during the past year, giving the airport a total surplus of $3,691 as of September 1, 1935. Last month, the city collected $820.75 from the sale of fuel, oil, current and other supplies at the municipal airport, whereas disbursements were $695.



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THE INDUSTRY IN GENERAL

Licenses of Pilots Ill 20 Days Suspended

LICENSES OF civil pilots who become ill and are unable to fly or follow their customary vocations for a period of 20 or more days, will be automatically suspended on the twentieth day, and the pilots will be required to be reexamined and pronounced fit by a Department of Commerce medical flight examiner if the examiner deems it necessary, before being allowed to resume flying, according to a new amendment to the Air Commerce Regulations which became effective November 1, 1935.

In an explanation of this amendment it was stated by the Bureau of Air Commerce, that under present regulations, holders of a student, amateur, or private pilot's license could be in an automobile or any accident not associated with aviation, or suffer from an illness which may run as long as 23 months, and upon recovering, resume flying. Furthermore, a commercial pilot could be ill practically five months and an airline pilot for over two months without any change in status as a licensed pilot.

The new amendment, which is added at the end of section 50 of Chapter 5, Aeronautics Bulletin No. 7, *Air Commerce Regulations,* follows:

(E) If a person, to whom any form of pilot's license has been issued by the Secretary of Commerce, sustains an injury or suffers an illness which, for a period of twenty, or more, consecutive days incapacitates such person from performing the normal duties for which licensed or from following his or her customary vocation or mode of life, the license of such person shall be automatically suspended on the twentieth day of such period, and if in the opinion of a medical flight examiner it is deemed necessary, such person shall be reexamined and pronounced fit before resuming the duties for which licensed.

August Exports $1,201,093

THE MILLION dollar mark once again was exceeded by exports of American aeronautical products when the August total reached $1,201,093, the best record over the past three-month period. Sales were confined largely to accessories and engines, with $498,109 and $487,792 respectively. Sales of 19 aircraft brought $212,603 and $2589 was realized from parachutes. Total value for the first eight months of the year reached $10,054,625, and more than $7,000,000 must be realized during the last four months to exceed the 1934 total.

Ninety-one engines were sold during the month, 34 going to Italy. These were worth $303,625. Chinese purchasers took 22, worth $64,260. Other sales of engines were made in Egypt (8); Colombia (5); Canada, Netherlands India, and Trinidad (3 each); Poland, Netherlands and Chile (2 each); and 1 each in Portugal, Panama, Mexico, Haiti, Brazil and Japan.

Brazil purchased the greatest number of aircraft—eight—during August, but Poland spent the largest amount $69,898, for one airplane. Japanese purchases of accessories reached $74,403, the highest total in this group, and Siam was directly behind with $69,170.

American aeronautical products were exported to 51 countries in August.

Business Reports

AIR ASSOCIATES, Inc., with branches at Garden City, New York, Chicago, Ill., and Glendale, Calif., declared a dividend of 75¢ per share on its preferred stock, payable October 1 to stockholders of record September 25. The volume of sales for the current fiscal year far exceeded any previous year in the company's history, according to H. I. Crow, secretary.

Stock of the Bellanca Aircraft Corp., has been listed on the Chicago Curb Exchange, whose board of governors approved the listing of 418,495 shares of $1 par value common stock, of which 175,750 shares are subject to trading on approval of the securities and exchange commission. The balance, 243,745 shares, may be traded in on notice of issuance.

Western Electric radio telephone equipment in R. J. Reynold's new tri-motor Stinson

Air Navigation Week Observed

OBSERVANCE OF Air Navigation Week, October 14-21 was featured throughout the country by various gatherings, exhibitions, and demonstrations, and by the visit to this country of the heads of civil aviation in Latin America and Canada.

Invited by the Secretary of State, these foreign officials visited Washington, Langley Field, Philadelphia, New York and Chicago before returning to their countries. Welcomed in New York by Mayor Fiorello LaGuardia, at Floyd Bennett Field, they also visited North Beach Airport and Roosevelt Field where they saw on review one of the largest concentrations of private craft ever assembled from one field.

Among the visitors were Cesar S. Grillo, Director of Civil Aeronautics, Brazil; Juan Rivero T., Chief of Railways and Air Transport, Bolivia; Francisco Mendes Goncalvez, Director of Civil Aeronautics, Argentina; Capt. Juan Ramos Munes, Chief of the Salvador Army Air Corps, El Salvador; Charles Fequiere, Chief of Shops, Supplies & Transportation, Haiti; Federico Recavarren, Inspector General of Aviation, Peru; Luis Felipe Marques, Director of Civil Aviation, Uruguay; Major Frank A. Felix Miranda, Chief of Aides of the National Army, Dominican Republic; Horacio Olivares, Director of Aeronautics, Chile; Raoul Guerdian, Minister for Foreign Affairs, Costa Rica; Agustin Parla, Inspector General of Airports, Cuba; Lt. Col. Luis Farell, Civil Aviation Department of Communications, Mexico; and J. A. Wilson, Controller of Civil Aviation, Canada.

Massachusetts Under Uniform Code

EFFECTIVE OCTOBER 13, ninety days after the signature of Governor James M. Curley was affixed to the bill making it law, Massachusetts became the 37th state in the country to have the act to establish a uniform aeronautical code.

Instrumental in working for the passage of this act, through the Massachusetts Legislature, was Maj. Clarence E. Hodge, Supervisor of Aviation for the Commonwealth.

Races Remain in Cleveland

AN AGREEMENT to hold the National Air Races in Cleveland for the next five years was signed by the National Aeronautic Association and the Ohio group which has sponsored this event since 1929. The N.A.A. reserved the right to place the meet in another city which offers special advantages on any two non-consecutive years in this period by giving eighteen months' advance notice.

(*Continued on following page*)

A Dream come True!

"For I dipt into the future,
Far as human eye could see,
Saw the Vision of the world
And all the wonder that would be,

Saw the heavens filled with commerce,
Argosies of magic sails,
Pilots of the purple twilight,
Dropping down with costly bales."
Alfred, Lord Tennyson, 1831

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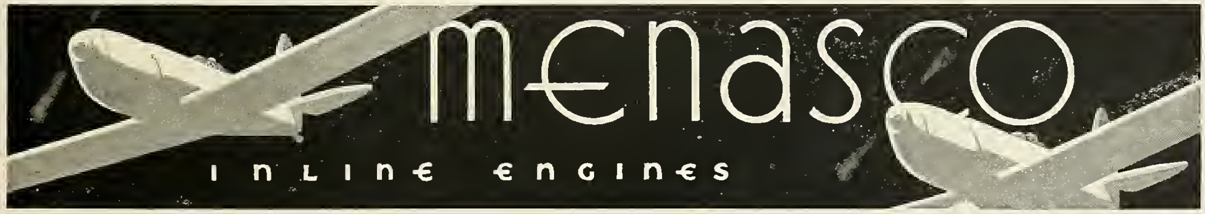

(Continued from preceding page)

Better Conditions Predicted

COMPLETING A trip which included practically every major aircraft center in the country, Val Dietz, Jr., sales manager, of the aeronautical division of Suncook Mills, found conditions in the industry on a sounder basis than ever before.

"Most factories," he said, "have unfilled orders on hand of sufficient size to assure their continuous operation for the balance of the year with a sizeable monthly production schedule. Most factories have doubled their number of employees and it appears that there will not be the customary dull period this winter as in previous years. A similar condition prevails among aeronautical supply houses, most of them finding their business running well ahead of last year."

Dietz reported that Nicholas Beazley has just opened another supply house at Love Field, Dallas, feeling the expansion justified by business improvement and increased sales.

Another indication of increasing activity induced by encouraging signs for 1936 is seen in the reopening of plants closed for the past three years, Dietz said.

England Buys Clipper Plane License Rights

MANUFACTURING LICENSE rights to the Sikorsky Clipper flying boat have been acquired by British Aircraft, Ltd., of Manchester, England. The deal, which has been under negotiation since July, was made with the United Aircraft Corp., of which Sikorsky is a member and involves about $500,000.

It is understood that the contract calls for the delivery of one S-42 to the British firm late this year or early next, while blue-prints and all other technical data on the manufacture of similar ships are to be turned over at once so that construction can be started as soon as possible in Britain.

Plane Sales Increasing

INCREASING DEMAND for luxury in the air led to the development of a new club model Lockheed Electra three of which have been delivered to private owners during the last few weeks. The bi-motored, 209 m.p.h. monoplane is identical to the standard Electras flown by many airlines, except for additional luxuries in the cabin and other special equipment. It is powered by two Wasp Junior engines. These planes were purchased by Major Max C. Fleishmann, Carl H. Beal, and Lorenz Iversen.

Charles J. Correll and Freeman Gosden, the Amos and Andy of the air, have each bought a new Stinson Reliant plane, while recent purchasers of Beechcrafts include A. C. Bostwick, Westbury, L. I. (B17L); Continental Oil Company, Ponca City (B17R); Duane Stranahan, Champion Spark Plug Co., Toledo (B17E); Mouton and Six, San Francisco Airport (B17R); George S. Armistead, Beverly Hills, Calif. (B17L); and Earl Ricks, El Dorado, Ark. (B17L).

Capt. Allen Hancock has purchased a Ryan ST 125 h.p. model for the Hancock School of Aeronautics, Santa Maria, Calif.

The delivery of the first of five Lockheed Electra airliners to Eastern Air Lines, division of North American Aviation, Inc., was announced by Capt. E. V. Rickenbacker, general manager. The new transports will be used on the company's lines from Newark to New Orleans, and from Chicago to Miami. These planes are powered with the new Wright Whirlwind 975E3 engine.

Beckwith Havens and Richard H. Depew, Jr., Fairchild distributors, report the sale of a new Warner powered Fairchild "24" three-place cabin monoplane to Thomas J. Watson, Jr., of New York City. This sale was made through their Rhode Island dealer, E. W. Wiggins, of Providence. Jim Erdman, factory representative for the Taylor Aircraft Co, Bradford, Pa., flew a new 39 h.p. Continental-powered Taylor Cub to Roosevelt Field for delivery to Spede Hanzlick of Jackson Heights. Erdman reported the sale of three Cubs to operators at the Congressional Airport, Washington, and one to John Truslow, of New York City.

New Aircraft Being Developed

LAMBERT AIRCRAFT Corp., Robertson, Mo., is designing the Monocoach, a four-place, twin-engined plane with provisions for 200 pounds of baggage. The engines will be Lambert 90 h.p. R-266's which are expected to give the plane a maximum speed of 170 m.p.h. and cruising speed of 145 m.p.h.

Assembly work on a new trainer series, open and closed models, is also under way. These planes are of the two-place, low-wing full cantilever, side-by-side type. Known as the Monoprep, the open models will have a useful load of 595 lbs., empty weight of 731 lbs. The closed de luxe or Monosport will have a useful load of 595 lbs., and empty weight of 922 lbs. The new trainers also will be powered with Lambert R-266.

(Continued on following page)

Digest of Recent Events

King Sets Another Light Plane Mark

A NEW world's altitude record for light seaplanes of approximately 16,000 feet was claimed by Benjamin King, Washington sportsman-pilot. Flying an Aeronca seaplane King exceeded the old record of 11,355 feet made by a French pilot in 1930. He took off and landed at the naval air station at Anacostia. SEPT. 24

Clipper Sets Mark On Trip to Hawaii

COMPLETING HER fourth flight from Alameda Airport in San Francisco Bay to Honolulu, the Pan American Clipper landed at Pearl Harbor. Although the Clipper set a new record of 17 hours 5 minutes between California and Hawaii, Captain R. O. D. Sullivan declared he could have made the trip in still faster time, for he circled over Oahu three quarters of an hour before he had sufficient visibility for landing. The flight cut seven minutes from the previous record.

Captain Sullivan continued westward to Wake and Guam marking the first time a plane reached the latter island from the East. OCT. 6

8 Glider Records Established in Russia

EIGHT WORLD glider records, three of them by women, were hung up in the eleventh all-Soviet glider meet. Staged at Koktebel in Crimea, the meet was featured by the large number of long distance air-train flights, five women scoring when they established a long distance record by flying from Leningrad to Koktebel in a three-glider train in thirteen hours and fifteen minutes. Other records were, Duration: one-place, two-place, and three-place gliders; 38 hours 10 minutes, 38 hours 40 minutes, and 11 hours 30 minutes respectively. Non-stop towed flight: 947.01 miles. Women's duration: one-place, and two-place gliders; 15 hours 30 minutes and 12 hours 9 minutes, respectively. Women's distance: 99.42 miles. OCT. 8

Bunch Attains Light Plane Altitude Mark

CLARE BUNCH, president and general manager of the Lambert Aircraft Corp., believed he had broken the altitude record for light planes. He reported his altimeter showed he ascended 19,500 feet, 900 feet higher than the previous record of 18,600 feet held by Wilfred G. Moore, Kansas City. B. L. Carter, vice president of the company, flew with Bunch as passenger. OCT. 12

Navy Seaplane Sets Two New Records

LIEUT. COMDR. Knefler McGinnis and crew of five in a Consolidated patrol seaplane, XP3Y-1 broke two international records for seaplanes, the record for airline distance and the record for broken line distance by their flight from the Naval Fleet Air Base, Coco Solo, Canal Zone, to San Francisco, Calif., and broke his own national airline distance record of 2398.999 miles. The XP3Y-1 took off from Coco Solo, Canal Zone and arrived at San Francisco, having covered 3,300 statute miles airline distance and approximately 3,450 statute miles, broken line distance. The previous international airline distance record for seaplanes was made on July 15, 1935, by the Italian aviators, Mario Stoppani and Casimiro Babbi, in a flight from Monfalcone, Italy, to Berbera, British Somaliland, airline distance of 3,063.166 statute miles. The previous international broken line distance record for seaplanes was established on December 31, 1933, and January 1, 1934, by the French aviators, Capt. de Corvette Bonnot and Lieut. de Vaisseau Jeanpierre in a flight from Berreport, Etienne, to St. Louis, Senegal, a broken distance of 2,356.980 statute miles. OCT. 14-15

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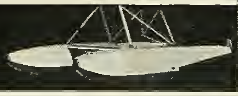

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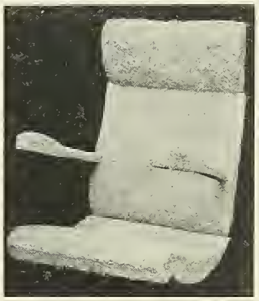

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Chase-upholstered interior of Martin Clipper showing compartment made up into dressing rooms

(Continued from preceding page)

New Corporations Formed

SPEED BIRD Airplane Sales Corp., has been formed for the purpose of selling and establishing dealerships for the new Speed Bird airplanes manufactured at Keyport, N. J. Officers are Walter Ivings, president; Ray B. Norby, vice-president and sales manager; Fred A. Anderson, secretary and general manager; and Francis Schmidt, treasurer.

The Speed Bird is an outgrowth of the Bird airplanes formerly manufactured in Long Island and for the past three years located in Keyport, under the management of Anderson who has maintained contact with the owners of Bird airplanes by supplying parts and materials. The new Speed Bird, designed by Lee Wallace, is a sesquiplane with accommodations for two, side-by-side, in a large cockpit, having adjustable seats, adjustable rudder pedals, the braking mechanism on the rudder pedal, semi-air wheels and a pneumatic tire tail wheel.

Toroidal Aircraft Motors Company of America, with headquarters at Omaha, has filed articles of incorporation. It has authorized capital stock of $25,000 and its incorporators are W. M. Haller, George D. Schellberg, J. D. Goodrich and L. J. Wolff.

Stearman At Capacity Production

CONTRACTS FOR 107 airplanes are demanding capacity operations by the Stearman Aircraft Company, Wichita. Deliveries have been made on seven planes recently ordered for use in the United States Navy. J. E. Schaefer, president of the company, says that orders on hand will keep his plant in full operation for several months.

Mr. Schaefer and Mac Short, vice-president of the company, have returned from the east where they were in consultation with government officials on new types of ships which it is expected the government will order in the near future.

Among contracts held by the Stearman company is one for 20 Naval training planes. These will be used at Pensacola, Fla. A recent order was given by the Army for 26 training planes.

The Stearman plant is making spare parts for Navy planes that will be equivalent to the building of 13 planes. Spare parts for Army planes now in process of manufacture will be equivalent to the building of four planes.

A sale has been made to the government of the Philippine Islands by the Stearman Far East agency.

COMING EVENTS

Gladys O'Donnell is managing director of the Women's National Air Races and Pacific Air Pageant to be held at the Long Beach Municipal Airport. Nov. 10-11.

•

The Eighth Annual Miami All-American Air Maneuvers will be held at Miami, Fla. Dec. 12-14.

•

1936 Aircraft Show will be held in Los Angeles under the management of Cliff and Phil Henderson. February, 1936.

•

An International Aero Exhibition will be held in Stockholm, Sweden. May 15-June 1, 1936.

Personnel Changes

BRANCH SALES offices of the Lockheed Aircraft Corp., have been opened in Dallas under the direction of Don Marshall, former pilot for Hal Roach who will maintain service for the company in Texas, Oklahoma, Arkansas, Louisiana and New Mexico.

Elliott Roosevelt resigned from the Aeronautical Chamber of Commerce as consultant on air transport matters, to accept an executive position with the Southwest Broadcasting System, Ft. Worth, Texas.

Appointment of Reginald V. Williams, president of the Gold Refining Co., as chairman of the aeronautics committee of the Buffalo, N. Y. Chamber of Commerce has been announced by Samuel B. Botsford, executive vice-president. Williams succeeds Theodore C. Knight, who was chairman of the committee for the past five years.

Directors of the newly organized Bell Aircraft Corp., of Buffalo elected recently at the first meeting of the management and original stock holders include Lawrence D. Bell president and manager; Ray J. Whitman, vice-president and treasurer; Robert J. Woods, chief engineer; and Charles A. Criqui, Sr., George Waite, W. A. Van Arsdale, and W. A. Yates.

Charles S. Doyle of Omaha has been named secretary of the new state aeronautics commission set up by the 1935 session of the Nebraska legislature. C. J. Campbell is chairman of the commission.

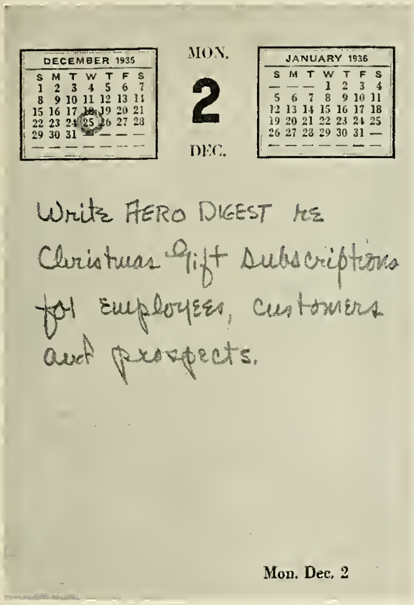
Joe A. Young, manager of the Little Rock, Ark., municipal airport for the past three years, has gone to Buffalo, N. Y., where he is now associated with the Curtiss Aeroplane & Motor Co.

George L. Lloyd, Manager of Aero Insurance Underwriters, announced the appointment of James R. Graham as manager of his Chicago Branch.

J. B. Bond was elected executive vice-president and general manager of Berry Brothers at a meeting of its board of directors at which time Tom Colby was re-elected vice-president in charge of aviation sales; Fred L. Colby, secretary-treasurer; and C. L. Forgey, general sales manager and advertising director.

Distributors Appointed

NEW AIRCRAFT distributors at Lambert-St. Louis Municipal Airport, St. Louis, Mo., were recently chosen. Airplane Sales Corp., recently organized with J. A. Davis as president, R. E. Patton, vice-president and Joe H. Imeson, secretary-treasurer and manager, will distribute the Rearwin in Missouri and Illinois. Brayton Flying Service, Inc., has obtained Missouri distributorship for the Taylor *Cub* and already has completed two sales. St. Louis Flying Service, Inc., has taken over Cessna distributor rights.



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FOREIGN NEWS IN BRIEF

Australasia

TRANS-TASMAN Air Development Co., Ltd., has completed arrangements with a British company to build under license in England flying boats for its service to New Zealand. The company has applied for permission to fly mail between Australia and New Zealand with a twice-weekly service, commencing next July. From present indications these planes will be the Sikorsky S-42 type, manufacturing rights for which have been sold to British Aircraft, Ltd.

AN EXTENSION of the service between Australia and London, which will be carried out soon, will be either Singapore or Bangkok to Hong Kong. The next extension will be a duplication of the service between Australia and London, with Sydney as the terminal. At present 50 percent of all mails, passengers, and express originate in Sydney.

WILFRED KINGSFORD-SMITH, manager of W.A.S.P. Air Services, Ltd., is now operating regular service between Leeton and Sydney, the present twice-a-week service to be expanded shortly into a daily service.

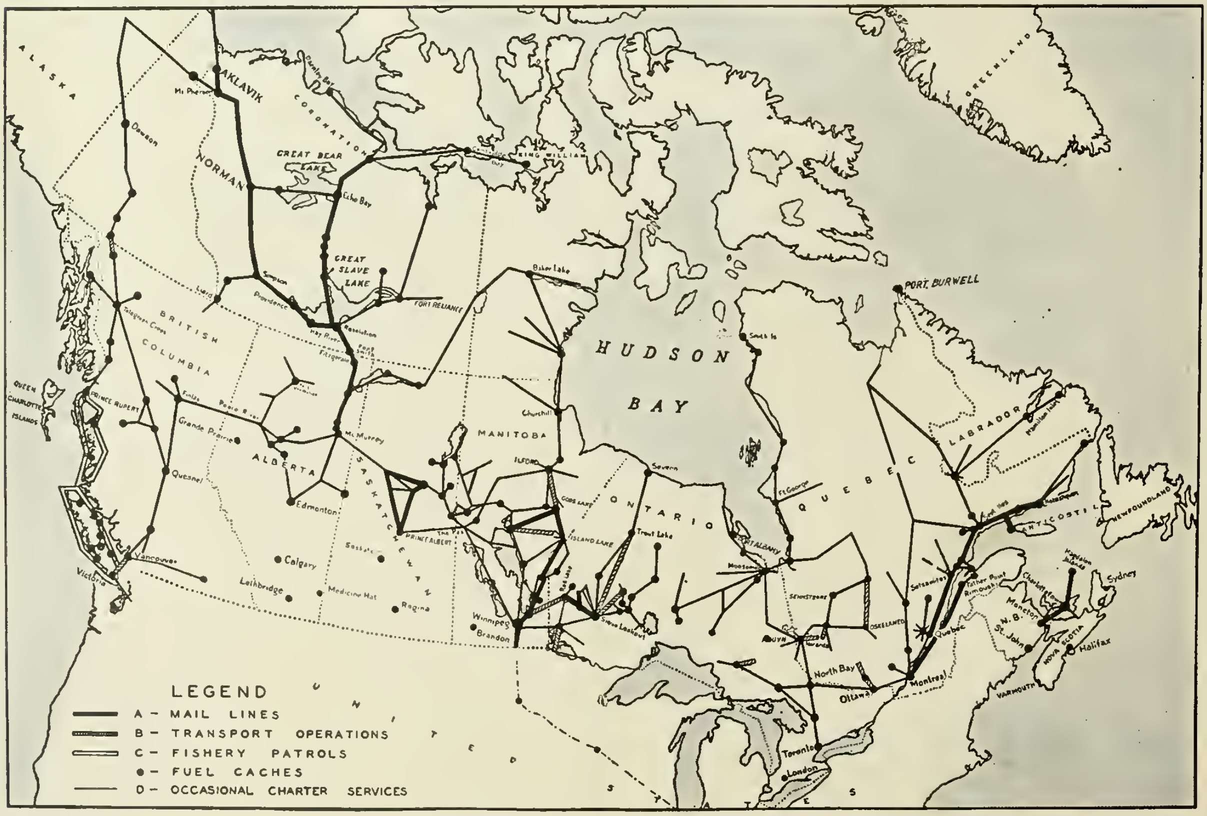
NEW ENGLAND Airways Ltd., has widened service between Sydney and Newcastle to two trips a day, while the Brisbane-Townsville service is now twice weekly instead of once. The company also initiated a Sunday mail service between Sydney and Brisbane.

THE DEFENSE Department has authorized the expenditure of £10,000 for new runways and drainage on airports in North Australia.

BEFORE THE end of the year, Imperial Airways plans to make a series of experimental flights between Penang and Hong Kong with a view of eventually linking the England-Australia airway with China and Japan. First flights are to be made by four-engined landplanes, though regular service between the Malay Peninsula and Hong Kong may eventually depend upon marine aircraft.

Canada

THE DEPARTMENT of National Defense, Civil Aviation branch, reports that during the second quarter of this year, 26 mail services were in operation; 1,227 trips were scheduled and 1,329 performed, while 148,744 miles were scheduled and 176,428 flown. According to a summary of the activities of the 22 clubs in Canada for the second three months of the year, the Toronto Flying Club led with 885 of the total 5300 hours flown. Canadian Airways, Ltd., from April 1



Map showing routes flown by Canadian Airways, Ltd., and indicating connection with U. S. mail route to June 30, 1935 flew 1,128 hours and 106,142 miles carrying 472 passengers and 181,516 lbs. of mail.

IT IS understood that the Ontario Provincial Air Service, a government-owned and operated organization for patrolling the northern bush against fire and for carrying forestry firemen to and from fires, is experimenting with new types of planes to find a type which is also efficient for scouting and freighting work. At present deHavilland *Moths* are used largely for patrolling, with Fairchilds and Hamiltons for carrying men and equipment to fight fires.

WITH A view to advancing the progress of the contemplated transatlantic air service linking the United Kingdom, Newfoundland, Canada and the United States, the British Air Ministry has completed a survey of the interior of Newfoundland near Grand Falls with the object of discovering a suitable marine base for flying boats, as well as sites for planes equipped with wheels or skis. Port Botwood, tentatively selected as a flying boat base, is unsuitable for a land airport, and an Air Ministry commission is surveying Cobb's Camp area between Benton and Glenwood with a view to finding a suitable base.

A NEW international air mail route was opened early last month between Vancouver and Seattle, making the third international air mail route between Canada and the United States operated from Canada. The other two routes are between Winnipeg and Pembina, and Montreal and Albany. This is the first inter-city air route to have been put into operation by the government since the economy move which cancelled most of these routes in 1931.

AT THE Brant-Norfolk air meet held early last month at Brantford, Ontario, C. Eardley Wilmot won the 48-mile derby and the balloon bursting contest while competing against participants from cities in southwestern Ontario. The meet was held for two days and was attended by a number of flying club members.

France

WORK ON the Bordeaux-Teynac airport is scheduled for completion in time for formal opening by the Bordeaux Chamber of Commerce in January, 1936. $3,310,000 is being spent, of which the general council of the Gironde has contributed $496,000 and the Chamber of Commerce of Bordeaux $463,400. The airport area was increased from 297 to 618 acres and another 358 acres are to be added; the airport will be 8,200 feet in length. A metal hangar with an area of 64,584 sq. ft. is complete and a second, as well as a station building, are now nearing completion.

A PROPOSAL to create an airport at Gennevilliers, Department of the Seine, is under consideration. The site, containing some 1,100 acres, is about the same distance from Paris as Le Bourget. Estimated cost for the airport is about $11,250,000.

AIR FRANCE has inaugurated its Paris-Rome service. New Potez planes, powered by Gnome and Rhone engines, giving a cruising speed of 170 m.p.h., are used over the land sections. Stops are made at Lyons and Marseilles. Over the Mediterranean (about 400 miles), tri-motored Wibaults are used.

Germany

CONTRACTS HAVE already been let for the construction of a hangar for the LZ 129 Zeppelin at the new airport being built at the intersection of the Hamburg-Basel and Wurzburg-Mainz roads, Frankfort. The hangar will be 922 ft. long, 197 ft. wide and 180 ft. high, and the airport will be the terminal for the airship when used in the South American service and for other ships which may be built by the Zeppelin company. The structure, which is expected to be completed by April 1936, will contain a circular rail track and cars for handling the ship under all weather conditions.

Frankfort was chosen in preference to Friedrichshafen because its air pressure at the lower altitude increases the ship's lifting power by 10 percent, thus enabling the carriage of more cargo.

Great Britain

THE KING'S Cup Air Race this year was won by Flight Lieutenant T. Rose, who averaged 176.28 m.p.h. in a Miles *Falcon* low-wing cabin monoplane, powered with a 200 h.p. Gipsy VI engine. Flying Officer H. R. A. Edwards was second in a Miles *Hawk* Trainer, and Lieutenant O. Cathcart-Jones took third in a similar aircraft. The Siddeley Trophy, presented for the best performance by a club-trained pilot flying an aircraft entered by a club, was won by C. E. Gardner of the Redhill Flying Club, who finished seventh in a Percival *Gull Six*, at an average speed of 170.08 m.p.h. The fastest time was made by Capt. E. W. Percival in a Percival *Mew Gull*, his average over the whole course being 208.91 m.p.h., the best average speed reached in the history of the race, which is over a 350-mile triangular course.

CONSTRUCTION IS proceeding at the Bristol works on a stratosphere plane which is to be used for experiments in flying at altitudes considerably greater than the present world record of 47,350 ft. Main components are taking shape, and development is progressing on the engine which is being designed to maintain adequate output at 50,000 ft., and more. It will be equipped with a controllable-pitch propeller.

FOLLOWING THE completion of autogiro tests from the deck of the aircraft carrier *Furious* there is a likelihood that these planes may become part of the equipment of the Fleet Air Arm within the next few months.

In the past twelve months almost 100 have been sold by the Avro company, which owns a license for their sale and manufacture, ten going to the Air Ministry for experimental flying with the army cooperation squadrons of the R.A.F.

AMONG THE new schools being formed to train candidates for short service commissions in the R.A.F. is a branch of Air Service Training Ltd. This school will be located at Ansty, near Coventry, and will be available for training in January, 1936. Flight Lieutenant R. P. P. Pope, for some years chief flying instructor at the Hamble division of the school, will be chief instructor at Ansty. Training aircraft will be Avro *Cadets*.

A NEW system of season or commuters' tickets whereby a reduction of 20 percent can be obtained on existing fares to regular air travelers has been instituted by Imperial Airways. A passenger may now buy a book giving him $372 worth of transportation for $297.60. The book may be shared with three other members of the purchaser's family, and is good for 4 months. A book costing $793.60 and worth $992 is good for a year.

A FLEET of flying boats, each of which will have a gross weight of more than 17 tons, has been ordered from the Short company by Imperial Airways for use on the main Empire air routes in preparing for the expansion of traffic that is scheduled to take effect in 1937, when the Empire services will be greatly accelerated and increased in frequency. By the close of the following year government plans to carry all first-class mail by air should be in full operation.

The new boats will be four-engined high-wing cantilever monoplanes with no external wing-bracing struts, and with the engines mounted in nacelles in the leading edge of the wings, two on either side of the central line of the hull.

Wing span will be 114 ft., length overall 88.5 ft., and height almost 29 ft. The boats will be all-metal, except for the fabric covering of portions of the wings and the tail unit.

The hull will be divided forward into

two decks. On the upper deck will be the crew's quarters and mail and cargo compartments; the lower deck will be for passengers, and will include sleeping berths.

HIGH CRUISING speed, combined with ability to operate from restricted areas, is secured in the design of the new version of the Boulton-Paul P.71A passenger biplane, two of which are used by Imperial Airways for special charter work. The chief modification embodied in the new model is the substitution of two Bristol *Pegasus* 690-750 h.p. engines for the 460 h.p. engines in the Imperial Airways planes. With the new power plants, the machine reaches a maximum speed of 195 m.p.h. at 5000 ft., and cruises at 166 m.p.h. Its stalling speed is 63 m.p.h.

THE NEW Saunders-Roe boats which will probably replace obsolescent craft now in service with the Royal Air Force, are noted for their seagoing qualities and the crew's accommodations. On open-sea reconnaissance duties and coastal patrol they carry a normal complement of pilot, gunner, navigator, engineer, and radio operator, and with full fuel load have a range of more than 1,000 miles. Except for the fabric which covers part of the wings, the machine is all-metal.

Wing span is 120 ft., length overall a few inches less than 90 ft., and height is 33.5 ft. The hull, built of aluminum alloys, is almost 90 ft. long and has a maximum depth of 12.5 ft., providing roomy accommodation for equipment and a crew of ten men. In the bow compartment is mounted a machine-gun or, alternatively, a 1½-pounder quickfirer. A hatch is fitted for the bomb-sight. Mooring gear is also carried in this forward compartment.

RECENT STATISTICS show remarkable increases in passenger and mail traffic carried by Imperial Airways. During the first three months of this year 564,835 passenger ton-miles were flown as compared with 367,038 for a similar period in 1934. For freight ton-miles the figure was 127,213, compared with 87,811 in 1934. Ton-mile figures for mail increased from 135,056 to 269,425; and passenger miles flown reached 5,884,234 as compared with 3,830,609 for 1934.

A REPORTED exceptional speed range, achieved by aerodynamical lift devices, is the outstanding performance feature of a new Handley Page general purpose military low-wing monoplane which is being tested at Martlesham, the experimental station of the Royal Air Force. Automatic wing-slots are fitted along the entire leading edge of the wings. Slotted flaps, which can be brought into action at slow speeds to increase lift, occupy the space on the trailing edge of each wing between aileron and fuselage. Interceptor plates, interconnected with the ailerons, are fitted aft of the wing slot; normally they lie flush with the wing surface, but when the aileron on either side is moved upward the plate projects above the surface, thus destroying the effect of the slot on that side and improving normal lateral control.

The Gipsy Six-powered Percival Gull, one of which competed in the King's Cup Race

A NEW Blackburn general purpose biplane is now undergoing trial flights. These general purpose aircraft are primarily intended for the efficient conduct of the duties imposed on those British service squadrons which between them are responsible for the policing of a million square miles of territory. They must be adaptable to perform many different tasks, and to carry a big load, while in addition, bombing, torpedo-launching, fighting, desert patrol, photography, ambulance work, and long distance reconnaissance are included in the work expected of them.

Mexico

ESTABLISHMENT OF an aeronautical department, similar to air ministries of some countries, is now being arranged by the Ministry of War and Marine. Jurisdiction over laws and regulations governing various phases of aviation; establishing airways, airports; stimulating aviation commerce; intensifying air tourist traffic; cooperating with the Ministry of Agriculture in using planes to combat crop pests, with the Ministry of Public Education for book-laden planes traveling wide circuits of country regions; mobilizing civil aviation in times of emergencies, and with the Public Health Department for service of flying dispensaries, are to be the principal functions of the new department.

Six air regiments are to be organized —three for combat, two for bombing and one for pursuit; corps of aeronautical and anti-aircraft troops will be formed; and the department will have charge of aviation schools, government aircraft factories and the supervision of airports.

ACCORDING TO the Aviation Department of the Ministry of Communications and Public Works, air transportation in Mexico increased from 1,248 passengers carried in 1,956 hours of flight that covered 12,205 miles in 1921-22, to 51,558 passengers transported in 35,178 hours of flight that covered 3,968,-369 last year.

SAFETY FACILITIES for aviators are being increased by the establishment of 30 radio meteorological stations at strategic points throughout Mexico. These stations will also broadcast special bulletins for farmers.

Russia

A NEW airline from Prague to Moscow is to be established shortly, operating on a schedule of 9 hours, about a quarter of the time taken by rail. The route is to go by way of Rumania, with stops at Uzhorod, Kiev, and Orel. From Kiev there are connections to Odessa, Tiflis and Baku.

Experimental flights are scheduled to take place this year from Prague to Russia. According to the proposed timetable, service will be on a tri-weekly basis.

THE SOVIET Union is rapidly building up Europe's most powerful air fleet, and occupies second place in the world's commercial airlines, according to A. K. Dawson, manager of the Russian Division of the American Express Co. Soviet routes extend over one-sixth of the earth's surface, and are based on three principal trunk lines, with their spurs. The most important is the line from Moscow to Vladivostock, extending more than 4970 miles. The Petropavlovsk-Alma-Ata route is one of the principal offshoots of the main line. Siberia and the industrial centers of the Urals and isolated portions of Central Asia are now connected by regular air service, and the third trunk line, Moscow-Tashkant, connects the capital directly with the Oriental south. By the end of this year, Soviet plans call for a total of 45,250 miles, on more than half of which passengers will be carried.

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• A COMPREHENSIVE review of specifications, properties and methods of application of modern thermostatic bi-metals is assembled for convenient reference in the latest *Blue Book of Thermometals* published by H. A. Wilson Co., Newark, N. J. Ten full-page charts showing deflection and force characteristics, along with appropriate design formulae, provide engineering data for bi-metal applications throughout the field of temperature indication and thermal control.

As a guide for choosing the most suitable type of bi-metal strip to meet specific operating conditions, the book contains complete mechanical, thermal and electrical characteristics for all standard types of Wilco thermometals. In addition, a simplified procedure for determining the length, type, and form of element in each case has been included.

The section devoted to derivation of thermometal formulae will aid those whose design problems require a more fundamental analysis than the standard formulae provide. Methods of heat-treatment recommended to relieve stresses set up in working or forming thermometal elements are outlined in detail.

Die Casting

• WITH THE development of the newer type alloys, based on an extremely high purity zinc, commercial die casters of this country have imparted an amazing amount of engineering skill and ingenuity to the development of their particular branch of engineering.

The booklet *A Visual Report of Progress* is a photographic review of this progress, and assembles the zinc alloy die casting applications of this new method of metal fabrication in a picture array that cannot help but astonish even the well-informed product designer. Hundreds of applications are shown—for the home, office, factory, automobile, and engine.

Published by the New Jersey Zinc Sales Co., N. Y., it is an outstanding effort designed to show that even a lifeless article like the casting, can be beautifully illustrated.

Cast Bronze

• DATA ON the uses and properties of various bronze alloys have been collected and published by Joseph T. Ryerson & Son, Inc., Chicago, as part of their new 26-page booklet *Permite Six-Foot Cast Bronze Bars.* The section devoted to physical properties covers such subjects as wear resistance, coefficient of friction, machinability, tensile strength, and hardness of many alloys. Graphs show the behavior of the alloys as contents of different metals are altered.

The booklet also shows, with the aid of photographs, the steps necessary in the production of finished parts from individual castings, from the short bronze bars, and from Permite six-foot bars. Case histories are included, in which costs and production time are compared.

Laminated Bakelite

• THE SYNTHANE Corp., Oaks, Pa. has issued a new folder *Synthane Laminated Bakelite for Mechanical Applications.* This folder contains the essential physical, electrical, chemical and mechanical properties of Synthane, some of the more important material strength values, representative uses, machinability, types of stock, shapes and colors. Due to the increasing trend toward the elimination of gear noises, one section deals with Silent Stabilized Gear Material and methods of gear cutting.

WE STAND FOR ANYTHING

(*Continued from page* 17)

And it is a very human trait to fear and distrust what we do not understand. The General Staff of the United States Army does not understand the air, and fears Air Power because it is the one great new menace to ground armies. Their fear of an enemy Air Power forces them to tolerate some little air force of their own. But they do not like it; they resent it. And their resentment, for all the world to see, is evidenced by the fact that they do not admit to the sacred earthbound organization known as the General Staff one single solitary air officer of the permanent rank of Major General or even Brigadier General.

To understand how little importance the Army attaches to the Air Corps, I shall quote from a list of General Officers of the Line, Major Generals and Brigadier Generals as of October 11, 1935. Of Major Generals there are 3 from the Engineers, 6 from the Infantry, 3 from the Coast Artillery, 2 from the Field Artillery, 4 from the Cavalry—and *none* from the Air Corps. Of Brigadier Generals there are 2 from the Engineers, 22 from the Infantry, 9 from the Coast Artillery, 7 from the Field Artillery,—and *none* from the Air Corps. Adding that up we have 18 Major Generals and 46 Brigadier Generals of the line, and *not an Air Corps officer in the lot!* It must be remembered that Air Officers commanding the Air Corps have never been of higher permanent rank than Colonel; the rank of Brigadier General, given to them for their term of duty, is merely temporary and is snatched away from them at the conclusion of that term.

In that exclusive organization known as the General Staff we had in June, 1933, 3 Major Generals, 4 Brigadier Generals, 5 Colonels, 28 Lieut. Colonels, and 63 Majors. To mention only one service, the Infantry, it supplies the General Staff with 1 Major General, 2 Brigadier Generals, 2 Colonels, 9 Lieut. Colonels, and 18 Majors and Captains. The Air Corps is represented by only one Lieut. Colonel and 3 Majors—all four of whom can be told to shut up by the 3 Major Generals, the 4 Brigadier Generals, the 5 Colonels, and probably the other 27 earthbound Lieut. Colonels.

Nine times out of ten on the General Staff the officer in charge of an air project is not an air officer, but a ground officer! For instance, it is known that the officer in charge of adjustments in the recent interchange of ground stations between the Army and the Navy was a Colonel in the Coast Artillery!

Is it any wonder that the Air Corps is the stray dog of the Army, thrown an occasional bone to keep it from starving to death, but not permitted to bark? Naturally the anointed Major Generals, Brigadier Generals, Colonels, and Lieut. Colonels of the Ground Forces are not going to let a mere Lieut. Col. and 3 humble Majors walk away with very much for the Air Corps: they're going to keep all they can for their own pet services. That is quite human and entirely understandable.

Appropriations are given to the Army in a lump sum, and then apportioned by the Army Staff to the several branches: Infantry, Cavalry, Coast Artillery, Air Corps, etc. The cost of operating the Air Corps is out of proportion to the cost of operating the other services, due to the cost of equipment and the rapidity with which that equipment is rendered obsolete by technical advancements in aviation. It is only natural that ground officers should feel that the Air Corps takes a disproportionate share of Army funds. Therefore, as all of the money given to the Air Corps is part of the Army budget, the ground people work on a basis of balancing a peace time Army organization. They apparently have only a vague conception of the overwhelming importance of Air Power in the next war.

Under a Department of Air, however, the Air Force would be under the sole command of an air officer, responsible only to the Secretary of Air and the President. No longer would a pathetic quartet of junior air officers have to beg humbly from the lordly groundlings, many of them amiable old gentlemen patiently looking forward to retirement and half

(*Continued on following page*)

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pay and nearly all of them loath even to think of a new and more deadly form of warfare which threatens the safety of the only sort of military life about which they know anything.

An independent Air Force, able to plan the defense of our country without the hampering influence of ground officers, will be able to give the United States a certainty in its protection that never will be possible under the present deadening grip of the ground Army. In the matter of coast defense, for example, the Army has spent over a quarter of a billion dollars on fortifications, all of which are now ineffective or obsolete. They furnish but little protection at enormous cost. They give absolutely no protection from air attack from carrier borne aircraft, either for the cities near which they are situated nor for the shipping in the harbors. The only defense against such air attack is by shore based bombardment aircraft sent against the carriers, or by aircraft from our own Navy, supplemented by pursuit aircraft based ashore, and by anti-aircraft artillery on shore.

Coast Artillery, which supplies 14 officers to the General Staff, can fire at most only 28 miles out to sea. What enemy carrier is going to come within that range when it can discharge its aircraft 200 miles out to sea? And what navy in its senses would risk the bombardment of shore based aircraft when it can stay several hundred miles away with some chance of safety, and send its carriers in close enough under cover of darkness to discharge bombardment airplanes. Against such an attack there is no defense but other aircraft supplemented by anti-aircraft artillery. The Coast Artillery, which is supposed to protect us from enemy navies, is today as dead as Dillinger. We've merely neglected to bury it.

Let the Army retire to the various Indian posts throughout the country, still surprisingly maintained by pork-barrel politics, evidently in fear that the Indians may stage an uprising. But let the air be guarded by an Air Force, commanded by air-trained officers who know by experience what it's all about. If that is accomplished by the McSwain bill, it will be a big step ahead for aviation. Incidentally, the Army would be conferring a boon on New York City if it would evacuate Governors Island, at present used only for social activities and polo playing. I really see no sense in leaving the Army stuck out in the harbor where, in the event of war, it would have to get itself a rowboat and paddle ashore before it could do anything. New York City could profitably use that ground, now devoted largely to afternoon teas and other social functions dear to the heart of the older or decaying species of Army officer. It would make an ideal landing station for our airlines. If the officers want some place to play, we'll trade them the Aquarium for the island. I think the old boys should be very happy among the other queer fishes.

I haven't space to discuss certain provisions of the bill that will have an effect upon commercial aviation, but I urge all school operators to study carefully Sections 31 and 32, establishing the Junior Air Reserve and providing for "the training of Cadets in such private flying schools and centers of air training as may be selected by the Secretary of Air for that purpose." This training is to be accomplished "by detailing either Regular flying officers or Reserve flying officers, called to active duty." I advise the schools to study this provision very carefully—there may be dynamite in it.

Furthermore, let the Air Line Pilots Association and other groups of airline personnel give study to this and see how they like it. It is Section 10, page 17: "That within one year from the passage of this Act all members of the air and ground crews including pilots, copilots, navigators, radio operators, inspectors, mechanics, and other persons employed in the maintenance and operation of all aircraft engaged in commercial air operations as common carriers shall . . . . be commissioned or enlisted in the Air Reserve." Why the stewardesses were not mentioned escapes me!

That paragraph obviously will render the Pilots Association helpless in any labor dispute. It seems to me that under Section 10 if any group of pilots stopped work, through a dispute with their employer, that they could be summoned to active duty in the Air Reserve next day and forced to fly the mail.

But in its main provisions for a United States Air Force, the McSwain bill H. R. 7041 merits our support.

FLIGHT PLAN

(*Continued from page 21*)

no reference to the auxiliary set is intended, its continued operation being assumed an additional safety factor.

In this example it is assumed that weather along the entire route will be generally favorable, and the procedure for each condition of radio failure would be as shown. These preliminary decisions by the pilot are based on available weather sequences, plus forecast developments, and whether during daylight or darkness; often specific fields or areas are shown as anticipated "outs."

Line 26 is intended for a contingency in which communication with the plane would be impossible. In that event the person named in the report can be consulted for possible further information regarding the pilot's plans and probable course of action.

The pilot now has a definite plan in mind, and can start his flight with complete data on conditions. In general he will follow the report closely, but in case unpredicted circumstances make this undesirable, he is free to deviate in accordance with his best judgment.

At first glance this flight plan procedure may seem lengthy and tedious but once familiar with the form, this is not the case. Only a portion of the hour before departure is ample for the pilot to complete the entire procedure. Actually, he normally considers everything mentioned. The conscientious filling out of this form assures him that he has not overlooked available pertinent information. Possible contingencies have been brought to his attention, and tentative decisions made. Furthermore his plans are in writing, and can be referred to without having to rely on memory.

The copy filed with the supervisory personnel gives them a definite estimate as to the probable progress of the flight, and in the event of complete radio failure they have a definite idea as to the remaining fuel range, and the pilot's probable procedure. The effectiveness of the plan can be checked, and if advisable, can be taken up with the pilot and the flight discussed on the basis of the facts and the figures shown.

The meteorological department is on the alert to supply the proper information well in advance of the flight. Formerly it was not uncommon for the pilot to receive some of the information necessary in planning his flight on a clearance form delivered to him just as the cabin door was being closed. Obviously, he could not study his data and make out an adequate mental flight plan under those conditions.

The advent of the flight plan has proven an important step in the training of co-pilots for pilot duties. They now have an opportunity to study the plans made by the more experienced men under ever-changing conditions. The decisions and the reasons are all apparent without the embarrassment of asking too many questions. They have an opportunity to work with their pilot in planning the flight and sometimes the more experienced co-pilots make out the entire plan under the supervision of their pilot.

Since the inauguration of the flight plan, TWA figures have shown a definite increase in on-time arrivals, and indications point to an increased operating economy.

A subsequent article in Aero Digest will give details of actual navigation during flight, in which the part played by the flight plan will be further described.

REACTIONS TO FALLING

(*Continued from page* 15)

motion may have been a factor. There were no abnormalities noted in the cardiovascular system. There was no empty or gone feeling in the abdomen. The eyes, although unprotected from the high wind blast, were not irritated and vision was normal.

Breathing was even, regular and undisturbed. The latter is noteworthy and contrary to expectations, as it is a common experience to have the breath taken away by a stiff wind about a street corner. Altogether, the undisturbed breathing, the unirritated eyes and the apparent loss of hearing bring up an interesting speculation.

Opinions of airplane designers and wind tunnel experts differ as to an explanation of these three unusual phenomena which are so contrary to expectations and previous experience. Some suggest a turbulent airflow about the body, producing small eddies and air currents instead of a strong blast. Others suggest that the body acts as a fairly good airfoil, the downward portion of the body acting as a leading edge and the upward part as a trailing edge, with a smooth, even flow of air over the surface. Still others suggest that there is a static air condition surrounding the body so that there is no flow of the air in contact with the body and that the pressure in the static area is a partial vacuum. Whatever the explanation, it no doubt has to do with the airflow about the body, and this fortunately is such that a perfect atmospheric environment is created.

The last phenomenon to be described is the only positive physical finding and is difficult of accurate description. It has to do with skin sensibility and was a result of the increased air pressure on the lower surface of the body. It consists of that force which restricts terminal velocity to 119 m.p.h. instead of infinity and appears in consciousness as a very gentle, evenly distributed, generalized, superficial pressure on the surface of the body toward the earth. The nearest possible similar earthly experience is that of being lowered slowly into a bed of softest down.

From a study of the subjective reactions to a free fall of approximately 1200 ft. in space, made by means of a delayed parachute jump, it may be concluded that:

The mental reactions are normal, except as influenced by fear, excitement or other factors not attributable to the fall.

There is produced only one abnormal physical sensation and this consists of a very gentle, evenly distributed generalized, superficial pressure on the downward surface of the body.

There is an apparent diminution of hearing acuity from an undetermined cause.

Position in space and motion through space are recognized solely by vision.

Depth perception acuity is such that a speed of approximately 100 ft./sec. at a distance of 1900 ft. from an object is required to recognize motion toward that object.

Delayed parachute jumps are an entirely practical means of avoiding certain hazardous aerial situations.

PERSONAIRLITIES

(*Continued from page* 45)

never to turn back in case of engine failure, he glanced ahead from his slight elevation of about 200 feet, and decided that Mr. Patrick must have been referring to some other field. For ahead of him was nothing but fences, trees, and houses. Mr. Walker decided to chance a turn of something less than half a circle and try to make a cross-wind landing within the airport. Instantly the radio went into action, and he could hear. "What's he trying to do?' followed by, "My God! Something fell out of the plane—he's going to have a forced landing . . . Hey! Drop your nose . . . You're skidding . . . Raise your nose . . . Drop it again . . . Don't slip it." Helped or hindered by these frantic instructions by radio, the Busy Executive became busier than he'd ever been before, and made a pretty fair cross-wind landing. They gave him the license.

In April of 1933 he purchased his first Monocoupe and proceeded to go in for cross-country flying in a big way, his first trip being from Cleveland to Tulsa, returning via Kansas City, Chicago, and Detroit. Since then he has visited and revisited practically every city of importance east of the Rockies on business trips. This spring he purchased a new Lambert Monocoupe and already has logged a great many hours in it. It's the fishing that runs up the hours, I understand. And soon the hunting season opens. Using an airplane in business saves time for hunting and fishing.

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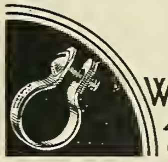

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USED PLANES FOR SALE

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WASP "B"—No. 1114
Total time unknown — no time since overhaul in our shops. Purchased from Western Air Express; formerly installed in Fokker. Has cast pistons, TWA exhaust valves and late B cam. Standard diameter pistons and cylinders. Radio shielded. Price ..$850

WASP "B"—No. 842
Total time approximately 800 hours. No time since overhaul in our shops. This is a STD B-type engine in excellent condition, very little wear and all parts standard size, including cylinder diameters. Price ...$800

Also have five good used Wasp B engines, total time unknown and approximately 300 hours since last overhaul. Formerly owned by Western Air Express. Standard Cylinders & Pistons, engine complete $350

Reground .010" Cylinders & Pistons, engine complete $300

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BETTER AIRPLANES FOR LESS

Aeronca C-2, 1 pl., just relicensed	$495
Buhl Pup, Szekely, engine overhauled	475
Curtiss Robin Seaplane, 3 pl., Chall., on Edo floats, complete with spare landing gear	1,800
Curtiss Robin, 3 PCLM, Chall., tail wheel, brakes	875
Fairchild KR-34, J6-5, excellent	1,350
DH-Moth, DH Gypsy engine relicensed, balloons	750
Sikorsky S-39 Amphibion, Wasp Jr., overhauled	5,000
Stinson "T" Trimotor, 2-way radio, night flying equipment	3,000
Stinson SM-7A, J6-9 330, excellent condition .	1,700
Stinson "S", 4-pl., Lyc., relicensed ..	1,750
Travel Air 4-U, Comet, steel prop., excellent .	850
Complete stock NEW & USED LYCOMING PARTS	
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Certified Licensed Used Airplanes

Waco F-2, Jacobs powered, excellent condition
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Waco, C, 1934, Continental powered, special paint job, prepared for radio
Waco J6-5 Straightwing, just relicensed, A-1 condition
Waco J-5 Straightwing, many extras, equipped for night flying
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WACO 10, just relicensed; Fahlin propeller; $400

New Wire Wheels.................. each,	$3.00
New Bendix Wheels, 30x5, with brakes, ea.	$22.50

Complete stock of Challenger engine parts

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FOR SALE

Travel Air 6000-B, J6-9, complete radio and instruments	$2,650
Fleet Model 2, Kinner front exhaust, excellent condition	1,495
2 Fairchild 24's, both same as new .	$3,500 & $4,200
Robin, Challenger motor just majored	1,100
Swallow TP, Kinner, excellent condition.......	650
Aeronca C-3, with cabin, like new	1,100

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Model 7—De Luxe. Kinner B-5, 125 h.p. engine, just majored. EXTRAS include Steel Propeller, Air Speed Indicator, Heywood Starter, extra Gas Belly Tank, Military Type Windshields. LICENSED September 1936.

Priced right for immediate sale

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Used Airplanes Bought & Sold
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OFFERED FOR SALE

Waco F-2, powered with A-70 Continental. Travel Air blue, trimmed with Diana cream. Completely rebuilt.

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Box 2177

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● PLANES and ENGINES FOR SALE

FOR SALE: Two-place Curtiss-Wright Amphibion, brand new and especially built for Wiley Post; complete with new Lambert 90, steel propeller, airwheels. Does not carry NC license. To be sold for less than cost to settle estate. Billy Parker, Bartlesville, Oklahoma.

CURTISS ROBIN: Challenger 185 h.p. Diana cream trimmed with black; speed ring, navigation lights, dual controls. Engine has 40 hours since major overhaul. Ship licensed until July 1936. $1,100. Bill Phillips, 1245 Flatbush Avenue, Brooklyn, N. Y.

REARWIN JR.: Latest Szekely; plane recovered January 1935; engine factory rebuilt July 1935; licensed to March 1936. Very good condition; $600. V. E. Doan, 505 W. Washington, South Bend, Ind.

CHALLENGER DE LUXE ROBIN: Like new, motor just majored; airwheels, starter; four-place fuselage; $1,000 or trade for Waco or J-5 Travel Air. John Siems, Columbus, Nebraska.

$790; MONOCOUPE. New engine, K-5 Kinner. Total time, 63 hours. Licensed to December 1, 1935. Excellent condition. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

FAIRCHILD 24: 145 Warner. 3-place; less than 200 hours total time. $2,990. Henry Spellman, 715 Lawrence St., N. E., Washington, D. C.

SZEKELY 45 H.P. MOTOR: Priced reasonably. 300 East Exchange Street, Akron, Ohio.

FOR SALE: Waco F-3, Jacobs 225; 60 hours total time, never cracked, always hangared; radio, bank and turn, rate of climb; special paint job. Columbia Airways, Bloomsburg, Pennsylvania.

AERONCA COLLEGIAN: Like new, 156 hours, always hangared, privately owned; closed, cabin heater, Pioneer compass, wheel guards; just relicensed. Reason for selling, owner in bad health. A bargain, $1,050. P. O. Box 3, Ridgeley, W. Va.

WILL SACRIFICE for $600: DH Gipsy Moth; motor overhauled 40 hours back; new paint. Licensed until April 1, 1936. Clyde Cole, Gladstone, Michigan.

LYCOMING STINSON SM8A: 40 hours on motor since major. Propeller reconditioned. Interior reupholstered imitation leather. Wings just recovered. Ambulance attachment. Approved by D. C. $1,700. Also: Good used earth inductor compass. C. P. Heafey, 3522 Farnam Street, Omaha, Nebraska.

BIRD: Kinner K-5 (front exhaust). Just top overhauled and relicensed. New propeller, air wheels and always hangared. Must be seen to be appreciated. $1,000. C. M. Duckham, Kenton, Ohio.

NEW AMERICAN CIRRUS engines and parts. W. E. Berger, 6714 McKinley Avenue, Los Angeles, California.

FOR SALE: 4 complete brand new 150 h.p. 7-cylinder Axelson B aircraft engines, $150 each. Three used engines, $100 each. Air-Parts, Inc., Glendale, California.

AERONCA 1934: Total time 385 hours, 10 hours since completely recovered and engine rebuilt to 1935 specifications at the factory. Winter enclosure, new propeller and wired for navigation lights. Must be seen to be appreciated. Good reason for selling. Price $1,150. John Abiuso, Northumberland, Pennsylvania.

BEST BUYS ON PAGE: Less motors. B-5 6-place Ryan cabin ship, full airwheels, less motor; B-1 5-place Ryan cabin ship, full airwheels, with or without J-5 motor; J6-9 6-place Travel Air cabin ship, airwheels, excellent condition; 1 J6-7 250 h.p. Pitcairn, airwheels, loaded with instruments. These ships all NC licensed and priced to sell. Michigan Aero Motors, Jackson, Michigan.

SPECIAL FOR NOVEMBER ONLY: J-5 Travel Air, $850. If you want a good used airplane, write us your requirements. Terms arranged. Pioneer Aviation, Airport, Syracuse, New York.

WRIGHT J6-9 MOTOR: First check for $500 gets it. No time since overhaul. Modernized. Crated to ship. Alton Walker, 600 Graphic Arts Building, Kansas City, Missouri.

PORTERFIELD DEMONSTRATOR: LeBlond 70; five months old; 150 hours; compass, starter, speed ring, position lights. Mechanically perfect. New plane guarantee. $1,350. Trade. Roy W. Harmon, Commercial Airport, Coldwater, New York.

LONG WING VELIE MONOCOUPE: Licensed till September 1936. Perfect condition. Total time 431 hours. Price, $525. Frank Faulkner, Pitcairn Field, Willow Grove, Pennsylvania.

PORTERFIELD: Demonstrator equipped with lighted instrument panel, navigation lights, radio, batteries, generator, and engine speed ring. Only 90 hours since delivered by factory. Practically new airplane; priced $1,400, less radio; terms. Travel Air: Sport trainer. Wright Gipsy, just majored. Plane in first class condition. Equipped with radio mast, battery, generator, lights. $1,200; terms. Tarkington Aviation Co., Municipal Airport, Indianapolis, Indiana.

FAIRCHILD 24: Cabin. Also, 5-place J-5 Ryan, good condition. Witch Duck Aeroplane Corp., 250 Bank Street, Norfolk, Virginia.

FOR SALE: Stinson T Trimotor. Eleven-place. 140 gallons of gasoline. Equipped for express and mail. Full night flying equipment. Newly overhauled engines. Will consider Stinson Junior as part payment. National Airways, Inc., Boston Municipal Airport, Boston, Massachusetts.

J-5 RYAN B-1: Five-place cabin. Night equipment includes large type electric flares, landing lights, 12-volt battery and box. New covering and cables. Ship in perfect condition. Licensed to August 1936. Total time, 514 hours. Price, $1,300. Will sell less night equipment. R. Thomas, 4642 Springle Avenue, Detroit, Michigan.

REPOSSESSED AEROMARINE Salmson-powered Klemm: Licensed; like new; little time. Advise us down and monthly payment you can make. Finance Co., Hemlock, New York.

GIPSY MOTH: Licensed, ship just recovered. Motor 10 hours since major; air wheels, complete set instruments; excellent condition; will sell or trade for J6-5 ship. Joe Princen, Jr., Marshall, Minnesota.

AERONCA C-2: Single place, recovered; new cylinders, pistons, valves, rings and propeller. Unlicensed. $250 buys it. Need cash. Dudley Kelly, Route 1, Lexington, Kentucky.

MUST SELL: Swallow 2-place licensed sport training biplane; just completely rebuilt and recovered. Tank OX-5 with dual German Bosch magnetos, high compression, fully Millerized. LeBlond "90," nicely broken in. Hartzell and Gardner propellers. Warner, Lambert, LeBlond or Velie full NACA cowling. Pioneer air speed, temperature gauge, compass. Tubbs, Whitewater, Wisconsin.

J6-7 C3-R STEARMAN: 80 hours since major. Excellent fabric; pants, ring; Pioneer turn and bank, compass, air speed, besides motor instruments. Position lights, air-wheels, brakes. Entire ship and motor excellent. Will sacrifice. Must sell immediately. Located in Middle West. AERO DIGEST, Box 2167.

WACO F, 125 KINNER: Licensed until February 1936. Red and silver. Good condition; no student instruction; always hangared. $1,350. J. W. Barnhill, Owensboro, Kentucky.

MUST SELL: $1,500, or will trade for smaller ship or late model car: J6-9 S-6000-B six-place Travel Air, just relicensed to August 1936. A-1 condition. Completely equipped for night flying: 2 Wiley flares, retractable landing lights; Eclipse generator and control box; large bank and turn. Very latest RCA radio; hand inertia starter. C. W. Peffer, 7607 Green St., Chicago, Illinois.

FLYING BOAT: Biplane, wing spread 30 feet. Bargain. Homan Boats, Inc., Foot South Bayview Avenue, Amityville, L. I.; telephone: Amityville 130.

WACO 10: GXE model. Licensed to July 1936. In excellent shape and performs well. Bargain at $450. William Picune, 743 34th Street, North Bergen, N. J.

FOR SALE: Pitcairn, Stinson, Travel Air, Stearman and Fokker tail groups and wings. J-5; J-6; Challenger, Cirrus and Kinner motor parts. New J-5 rocker arm bushings, and new oversize pistons. 20 x 13-5 airplane tires, tubes and wheels; complete Heywood starters, and parts. Skyways, Inc., Municipal Airport, Cleveland, Ohio.

FOR SALE: J-5 Travel Air; Avro Avian; Stinson SM8A; artificial horizon; RCA and Stromberg aircraft radios, and 4C tuning units and dynamotors. Skyways, Inc., Municipal Airport, Cleveland, Ohio.

125 H.P. KINNER BIRD: 4-place. 260 total hours on ship and motor. Now equipped with Edo pontoons and water rudders. 160 hours since major motor overhaul. 15 hours since ship was completely dismantled, overhauled and recovered. Mechanical condition as good as new ship, appearance far superior to factory finish. Equipment includes Airwheels, brakes, Heywood starter, Switlik chute, air speed, turn and bank, rate of climb. Licensed to July 15, 1936, on land and sea. Always kept in private hangar on fresh water. Considered by many prominent pilots best Bird ever built. $3,500; no trades. AERO DIGEST, Box 2164.

STINSON LYCOMING SM8A: Excellent condition throughout; licensed to August 1936; 460 total hours, only 123 since complete modernization at factory; balloon tires, leather upholstery, standard instruments plus turn and bank and rate climb; electric starter and lights; colors, blue and silver. Now only $1,650. S. L. Huey, Devils Lake, North Dakota.

$1,450 LYCOMING STINSON: 60 hours since complete recover and motor overhaul. Snappy red and yellow colors. New battery, starter, ring. Alton Walker, Graphic Arts Building, Kansas City, Mo.

HUNDREDS of bargains in planes, motors, crack-ups, parachutes. Every price, every location. Fall Directory, just out, sent anywhere for 20c, postpaid. Used Aircraft Directory, Athens, Ohio.

SPECIAL FOR NOVEMBER ONLY: Waco F, $1,250. Pioneer offers big reductions in water- and air-cooled powered airplanes; all makes; terms. Write Pioneer Aviation, Airport, Syracuse, N. Y.

1934 WACO CABIN: Continental; total time 440, 60 hours since major overhaul at Continental factory when salt-cooled valves were installed. Extras include lights, flares, pants, 70-gallon tanks, radio and air brakes. In absolutely perfect condition, and priced low. Jack Gillies, Aviation Country Club, Hicksville, L. I., New York.

STINSON RELIANT: 1934 model; total time 365 hours, 100 hours since complete major overhaul; painted black with red trim, equipped with landing lights, flares, excellent radio, 75-gallon tanks, rate of climb, turn and bank, thermocouple; special leather upholstery, etc. Like new in every respect. $4,000 for quick sale. R. D. Morgan, Bellanca Field, New Castle, Delaware.

PITCAIRN AUTOGIRO: Small 125 h.p. model, practically new. Real performance, lands anywhere, easy to fly. Special finish, many extras. Can deliver. Trade-in considered. AERO DIGEST, Box 2169.

LAMBERT MONOCOUPE: Licensed to June 1936; majored 18 hours ago: new covering and fully equipped. Price, $1,175. Will consider trade on larger plane. Robert Freed, Box 303, Pender, Nebraska.

REPOSSESSED THADEN: All metal, 4-place, J6-9, just majored monoplane. Beautiful ship, stable; performs, 140 high. 125 cruise. Cost $13,000. License forever. $1,500; $300 down and balance monthly. Aviation Finance Co., Hemlock, N. Y. Act quickly on this one.

LOW-WING SPORT AIR-ISTOCRAT: Completely reconditioned, less engine. Takes 110 to 165 h.p. Wheel pants, full NACA cowling, adjustable for cooling for Warner. AERO DIGEST, Box 2168.

WACO J-5 STRAIGHTWING: Licensed May 1936. Parachute. Sign towing cut out letters. Fine condition. All, $1,200. O. MacRobert, Candler Field, Atlanta, Georgia.

FAIRCHILD 22: Rover engine, licensed to October 1936; in excellent condition; $1 000. Rising Sun Airport, Inc., 861 E. Luzerne St., Philadelphia, Pa.

CHALLENGER 4-PLACE de luxe Robin: Cabin type, 4C1-A; 185 h.p. Total 245 hours; just relicensed to September 26, 1936. Two cabin doors, side-by-side full seats, side-by-side duals, heater, Goodyear Airwheels and brakes, tail wheel, steel propeller; always hangared; broadcloth upholstering not worn or torn; orange and cream; $1,400. R. E. Searle, Ogallala, Nebraska.

**CLASSIFIED FORMS CLOSE
NOVEMBER 18th**

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10c. Per Word; $2.50 Minimum. Payable in Advance.

PLANES and ENGINES FOR SALE

STINSON: 1934 Reliant. 225 hours. Night flying equipment and other extras. Ship good as new. $4,750. Monocoupe: D-145. Warner engine. 200 hours. Color, steel dust gray, Berry red trim. $2,500. Travel Air: 12-W. 125 h.p. Warner with latest type heads. 425 hours. 100 hours since major. Electric starter and other extra equipment. $1,600. Warner engine: 125 h.p. Serial 297. Just major overhauled. Sioux Skyways, Sioux Falls, South Dakota.

AERONCA C-3: Duals, winter enclosure, airwheels, oleos; motor 10 hours since factory major; licensed October 1936. Ship perfect throughout. $800. AERO DIGEST, Box 2174.

REARWIN JR.: Szekely 45. Ship and motor in excellent condition. $625. P. O. Box 429, Waycross, Georgia.

TANK TRAVEL AIR: Good condition, airwheels; just relicensed; motor 15 hours. $850. Will trade on Warner Monocoupe or Fairchild; Stinson S, Waco C, $800 cash difference. John E. Ayers, Morrell Station, Baltimore, Maryland.

FOR SALE OR CHARTER: J6-5 special Aristocrat. A-1 condition. Completely modernized; pants, fairings, speed ring. Tops 140 miles. Few hours since major. Blind flying instruments. Roy Hamilton, 70 Ft. Greene Place, Brooklyn, N. Y., or Hangar 3, Floyd Bennett Field.

WACO STRAIGHTWING JACOBS: Licensed July 1936. Refinished last spring. Extras: Bank and turn, rate of climb, Heywood starter, tail wheel, military visor, speed ring, front cockpit cover. Always hangared and privately owned. Excellent condition. AERO DIGEST, Box 2173.

FOR SALE: K-5 front exhaust Kinner Lincoln. Ship just been overhauled, total time on ship 1590; total time on motor, 94. Colors, red and yellow; equipped with air wheels. Price, $1,650. Aeronca C-3 with E-113-B motor. Winter enclosure, streamline landing gear and tires. Total time 475. Colors, red and yellow. Motor overhauled at factory at 300 hours. Price, $1,250. John M. Donalson, Municipal Airport, Birmingham, Alabama.

LOCKHEED VEGA: Bargain for cash; ship practically new; Wasp S-1-D-1, ten hours since major. Bowen Air Lines. In perfect condition. Many extras: landing lights, radio, generator, starter and flares; special paint job, white and purple. John Grimmett, care Nickson Hotel, Roswell, New Mexico.

AERONCA C-3: 1934. Enclosure. Ship like new; only 200 hours time. Engine 12 hours since factory major. Brakes. Licensed; $1,150. Kinner B-5 Waco F: New type heads. Ship excellent condition. Licensed; $1,750. Millerized OX-5, as is, $25. George E. South, Hamilton Airport, Hamilton, Ohio.

WARNER WACO F: 450 hours, 100 on motor. Blind flying equipment, drift indicator, clock, engine fire extinguisher, combination speed and collector ring, Heywood starter, wing root fairing and steel prop. Lowest cash price, $1,600. Consider trade for Waco C. John Peterson, Benton, Kentucky.

ENGINES: Majored by approved agency. Hornet B, $1,500; Hornet A-1, $850. Wasp S-1-D-1, $2,500; Wasp C, $1,100; Wasp B, $800. J6-9-D, $1,250; J6-7-D, $775; J5, $450. Kinner K-5, $300. Lycoming 215 h.p., $595. Bahh, 1100 Airway, Glendale, California.

SPECIAL FOR NOVEMBER ONLY: Kinner Eagle, $650. We buy and sell licensed airplanes. Send your requirements to us. Terms arranged. Pioneer Aviation, care Airport, Syracuse, N. Y.

STINSON MODEL "S": Never used commercially. 600 hours total time. Factory major overhaul at 450 hours. Engine, fabric and upholstery in perfect condition. Must be seen to be appreciated. Plane at Wayne, Michigan. For quick sale, $1,850. W. W. Naive, 986 W. Goodale, Columbus, Ohio.

FOR SALE: Fairchild 71; Standard 2-place trainer; KR-34; Taperwing Waco. All licensed, in good condition. Trades considered. Air Services, Inc., Akron, Ohio.

FAIRCHILD 5-PLACE CABIN: Fuselage changed, giving appearance of 71; high gloss finish, tailwheel, brakes. Just relicensed. Bargain for cash offer; trades considered. Cole Airport, South Euclid, Ohio.

SALMSON AD-9 ENGINE: Complete with propeller, motor mount, tanks, cowling and drawings for installation on Curtiss Jr. Makes Junior outclass all other light planes. $350. Cole Airport, South Euclid, Ohio.

REARWIN, JR.: Aeromarine motor just majored. Licensed till October 1936, with class one rating; an excellent trainer, $750. Blakeslee Flying Club, Main Street, Luzerne, Pennsylvania.

TAYLOR CUB: Aeromarine motor, 50 hours since major, 325 hours total. Licensed to July. Winter enclosure. $850. Kenneth Wright, Bernard Airport, Youngstown, Ohio.

FLEET DE LUXE: Model 8, three place. No time since engine was major overhauled by expert. Plane just relicensed, in excellent condition. Yellow wings, green fuselage. New June 1931. Kinner B-5. Equipment includes Sperry horizon, Kollsman altimeter, turn and bank, rate of climb, Crosley radio, blind flying hood, dual controls, brakes both cockpits, semi-air wheels. Price $2,150. Brayton Flying Service, Inc., Robertson, Missouri.

KINNER TRAVEL AIR: Sportsman, 16 K, 125 h.p., perfect; extras; $1,650. Aeronca, $775; OX-5 jobs, $400-$500. Cracked Fairchild 22. Dick Schall, Berwyn, Md. (College Park Airport).

WARNER MONOCOUPE: Latest type, with built-in rocker boxes; plane built November 1933; total time 250 hours; equipment includes complete streamlining with strut end fairings, wheel pants, racing landing gear; steel propeller, turn and bank, semi-airwheels; finish black fuselage, cream wings, vermilion trim; always hangared and cannot be distinguished from new; cruises at 125. Priced $1,950 for quick sale. Air Service, Inc., Bellanca Field, New Castle, Delaware.

FOR SALE: Stinson Jr. SM8A. '31 model. Motor majored, ship completely overhauled and recovered 350 hours ago by Stearman, Wichita. Special paint job, retractable landing lights; airwheels and full set of instruments. Upholstery like new. Never cracked up. Ship far above average. Price $1,650. C. D. Viles, Norborne, Missouri.

AERONCA C-3: 40 hours since factory major on E-113-A motor. Ship just relicensed. A bargain for cash. Harley McKee, Rexford, Kansas.

STEARMAN C3-R: Wright 250 h.p. In perfect condition. Relicensed September 15th. Landing lights, flares, blind flying instruments, starter, speed ring, pants; cruises 125 m.p.h. Best offer takes this ship; take smaller ship in trade. Philip Miraglia, 208 Irvington Drive, Tonawanda, New York.

FOR SALE: Waco Cabin 1931, excellent condition, 165 Continental motor. Extras: rate of climb, turn and bank, steel propeller, fire extinguisher piped over motor, radio. Privately owned and never cracked up. Licensed until September 1936. Price $2,000. Chas. G. Matthews, McConnell Field, Nashville, Tennessee.

FOUR-PLACE BIRD: Latest type Kinner, 170 hours total, by private owner. Heywood starter. Never cracked. Excellent condition. Will accept car in trade. Will trade for good used or new Stinson. Woodford Flying Service, Weston, West Virginia.

J-5 TRAVEL AIR: Engine majored, ship recovered, lights, exta instruments. J-5 Fairchild FC-2: late type, recovered, electric starter, lights. J-5 Eaglerock: majored and recovered. Challenger Command-Aire, many extras. Aeronca C-2. Air Activities Airport, West Chicago, Illinois.

J-5 STINSON JUNIOR: A-1 condition throughout. Bendix wheels and brakes, starter, and radio. 150 hours on motor since genuine major. Licensed June 1936. $1,000. Airplane Sales Corporation, Lambert Field, St. Louis, Missouri.

MUST SELL: J-5 Travel Air 6000, $1,300. Fifty hours since motor major overhauled. Completely recovered last June, high gloss finish. Night flying equipment and other extras. Lyle Strong, Wold-Chamberlain Field, Minneapolis, Minnesota.

EAGLEROCK OXX-6: Just relicensed, A-1 condition, compass, booster, wood and steel propeller. Bargain, must sell, $350. Inquire Jamaica Sea Airport, gas station, Springfield, New York.

THE ESTATE OF Mr. Whitney (deceased) will sell Warner Aristocrat. Engine no time since major overhaul, which cost $355. Plane in perfect condition. First $900 takes this bargain. No correspondence or terms or trades. Hangar 32, Roosevelt Field, Mineola, New York.

3 FOKKER TRIMOTORS: Equipped 3 Wasp 420 h.p. engines. Ships fully equipped, each $2,100. Lockheed Orion: $5,500. Fairchild 42: $1,950. Northrop Gamma: Cyclone engine; $20,000. Many other ships. Babb, 1100 Airway, Glendale, California.

WACO F-3: Continental 210 h.p. Beautiful condition, many extras. Total time 225 hours, special finish. Privately owned, always "babied." Dick Schall, Berwyn, Md. (College Park Airport).

OX-5 AMERICAN EAGLE: $450. Licensed till May 1936. Inquire Earl B. Hadley, Muncie Airport, Muncie, Indiana.

FLEET: Late type Warner, just overhauled, recovered; high gloss finish. Cockpits, seats leather-lined. Double instruments. J6-7 Travel Air, open, perfect condition, relicensed. Howard Schmidt, 20-16 Whitestone Avenue, Whitestone, New York.

AVIAN: Latest model built. Excellent condition, very attractively refinished. Just relicensed. No time since last top overhaul. Bargain. Richard Behrens, 133 Lincoln Avenue, Mineola, New York.

SPECIAL FOR NOVEMBER ONLY: Licensed OX-5 Waco, $275. We deal exclusively in licensed airplanes, all makes. Terms arranged. Write Pioneer Aviation, care Airport, Syracuse, N. Y.

FLEET, KINNER K-5: Front exhaust, 100 h.p. Completely reconditioned, beautiful hand rubbed finish, perfect throughout. $1,000 cash. Porterfield LeBlond: Demonstrator, special finish, speed ring, just like new. Sacrifice. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

ROBIN B-2: OX-5, Millerized; silichrome, Bosch magneto, duals, compass; blue and silver; licensed July; $550. Waco 10 OXX-6: Silichrome, duals, Millers, clock, large wheels; licensed June; $500. L. Wuilleumier, Madison, Wisconsin.

OX-5 CHALLENGER: Excellent condition, $450. Warner Fleet: Heywood starter, airwheels, brakes, speed ring, 450 hours total. Will finance. Congressional Airport, Rockville, Maryland.

'35 MODEL Warner Fairchild 24: 90 hours total; guaranteed perfect throughout; make big saving. Max Marshall, Xenia, Ohio.

WACO 10: OXX-6 motor; finished in Fokker red with silver wings. Excellent condition. Will sell for cash or on time. Must sell immediately. L. E. Pickard, Dansville Airport, Dansville, New York.

1933 DE LUXE STINSON Reliant: Cannot be told from new. 180 hours since major; full equipment, including bank and turn, rate of climb, landing lights, flares; bonded for radio; pants, 72-gallon gas tanks, red leather upholstery. Color, International orange and dark blue. A real buy. H. W. Bresee, 650 S. Salina St., Syracuse, New York.

J-5 EAGLEROCK A-1: engine, plane perfect; cruises 100 m.p.h. at 1450 r.p.m. Bendix wheels, brakes. Red Fokker fuselage, silver wings. Will consider 3-, 4-place closed job. Also OXX-6 Eaglerock, $300. Lomhardo, 251 East 31st Street, New York, New York.

VELIE CAVALIER: Perfect condition. Just recovered, motor majored. Licensed September 1936. $625. Consider light car in trade. Also Velie motor, A-1 shape, $115. Wm. J. Schulte, El Reno, Oklahoma.

J-5 STANDARD: Excellent condition, licensed June 1936. Cash, or will trade for good three-place open job, suitable training; not over 185 h.p. AERO DIGEST, Box 2181.

DH MOTH: Licensed until October 1936. Airwheels, compass, duals. Always privately owned. Only 250 hours on ship. Will sell for cash only. Write Charles Foy, Clinton, Iowa.

TRAVEL AIR C-4000: Late type Challenger engine. Little time since major overhaul of engine and airplane by approved repair stations. Must be seen to be appreciated. One of the most beautiful open airplanes in the country. Hand-rubbed finish, chromium plated struts, hand starter, low pressure tires, brakes, pneumatic tail wheel, Townend ring, military windshield, metal front cockpit cover. Many other extras. $1,500 cash. No trades. Lansing Aviation Club, 615 North Capitol Avenue, Lansing, Michigan.

AERONCA C-3: $750. Also later model C-3, $950. E-113-A motors, no time since factory major. Airwheels, oleos, enclosure. Terms or cash. Wire "Al" Leeward, New Kensington, Pa.

WALLACE TOUROPLANE: Total time, 250 hours; with Kinner motor, total time 54 hours. 3-place cabin, side-by-side duals, brakes, folding wings, Pioneer bank and turn, airspeed, compass, clock, licensed till October 1936. $975. Will take automobile or open ship as part payment. Deliver anywhere for expenses. John Herner, 933 Franklin Avenue, Brooklyn, New York.

DEADLINE FOR CLASSIFIED ADVERTISING, DECEMBER ISSUE—NOVEMBER 18th

Copy arriving after that date will be held over for the January issue

CLASSIFIED ADVERTISEMENTS

10c. Per Word: $2.50 Minimum. Payable in Advance.

● PLANES and ENGINES FOR SALE

NICHOLAS-BEAZLEY NB-4: Low wing monoplane, 3-place, Warner powered, brakes, 10 x 6.50 wheels and tires; absolutely perfect, $675; or trade for car or cheaper ship. Ted Morris, 4915 East 15th Street, Kansas City, Missouri.

USED CONTINENTAL CUB: $750. Slightly used Aeromarine Cub, 75 hours, $1,195. J6-5 Travel Air, $1,195. Taylor Aircraft Company, Bradford, Penna.

FOR SALE: 5-place J-5 Stinson; ship A-1 condition, completely recovered and rebuilt one year ago. Make offer. Licensed until October 1936. Hunter Moody, 761 S. Franklin St., Decatur, Illinois.

VERVILLE: 165 Continental, 230 hours total. Ship and engine in perfect shape, just relicensed. Has air starter, steel propeller, brakes and semi-air wheels. $1,500. Montgomery School Aeronautics, Montgomery, Alabama.

OX COMMAND-AIRE: Trainer, in good flying condition. Can be relicensed with little work. $245 cash. Herman Zierold, 834 Richards Road, Municipal Airport, Kansas City, Missouri.

WARNER STINSON: $195, less engine; flyaway delivery. Warner engine: $275, new type heavy duty heads, crankshaft, valve drive. Steel propeller, $60; Warner, Kinner, OX-5. Warner Cessna: $795. Parts. Merle Buck, Huron, South Dakota.

FOR SALE: Taylor Cub, new September '34. 300 hours, motor just majored, $975. Cavalier Coupe, Velie 65 h.p. motor; licensed, $400. Simplex midwing monoplane, Kinner K-5 motor, unlicensed, $400. All ships in good flying condition. Clayton Lemon, P. O. Box 2144, Roanoke, Virginia.

CARR SPECIAL: 125 Warner, steel propeller, streamlined one-place low-wing; motor just majored; $775. Consider trade. Gene LaVigne, 250 Hendrie, Detroit, Michigan.

FOR SALE OR TRADE: Warner Stinson, just refinished. Motor 10 hours since major; bank and turn, rate of climb. Licensed, in excellent condition, $775. Waco 90, new covering, 1930 model, excellent condition, $450. Photos on request. K. W. Reed, Box 176, LaCrosse, Wisconsin.

BARGAIN: Travel Air 2000 OXX-6; new motor, total time 60 hours; polished finish, speed windshield, compass, airspeed, pitch bank, duals, $425. David Rauh, 593, Nantucket, Mass.

KINNER BIRD: Licensed to November 1936. Plane just refinished. Airwheels. K-5 motor, 140 hours since major; $1,175. Donald Hood, Belmont Avenue, Northampton, Massachusetts.

AERONCA C-3: Newly recovered and engine majored. Green fuselage, gold wings and tail surfaces. No time since recovering. $850. Cincinnati Aircraft Service, Lunken Airport, Cincinnati, Ohio.

DOYLE: 2-place parasol. LeBlond 60. Licensed. 335 hours. Now being majored. Excellent condition. Air wheels, lights, compass, airspeed. $750 cash. Robert B. Taft, Charleston, South Carolina.

3 POLB CHALLENGER TRAVEL AIR: 600 hours on ship; 250 hours on engine; $900. Waco 10, excellent condition; compass, extra metal prop; $425. Dead storage in modern fireproof hangar; $10 up; ships called for and delivered. Ralph Wilson, Suffolk Airport, Westhampton Beach, L. I., New York.

LOENING COMMUTER: Amphibion; J6-9, modernized to D. Completely overhauled, repainted and relicensed. $2,500 or trade for 71 Fairchild. Douglas Burton, Lake George, New York.

FOR SALE: Waco C, 165 Continental; 570 hours, 35 since factory major; privately owned, perfect condition, $1,800. Leather upholstered. Walter H. Bryan, 306 Glendale, Waterloo, Iowa.

BARGAIN: J-5 semi-speed wing Travel Air; semi-air wheels, brakes, compass, tail wheel, metal propeller. Just relicensed. $910. Lester Jolly, Devils Lake, North Dakota.

WATKINS SKYLARK: LeBlond 85, low-wing, two-place. Speed wing, duals, cover and finish very good. Identified; $295 or will trade. Norman Kramer, Syracuse, Kansas.

SZEKELY BULL PUP: Ship and motor excellent condition. Recently majored. Licensed to June 1936. Price, $425. Richard Carson, 265 S. Second Street, Chambersburg, Penna.

WARNER TRAVEL AIR: Recently recovered, motor modernized; turn and bank, steel propeller, air speed, compass; licensed May 1936. $900. Accept late car part payment. Shenandoah Motor Company, Inc., Winchester, Virginia.

ATTENTION: California Pilots. Fine Stinson "R," excellent finish, condition, $300 extras, red leather. Trade for bungalow, business property on coast. Sell outright. Dr. E. H. Haynie, General Delivery, San Bernardino, California.

TAYLOR CUB: New Continental A-40-2. Duals, winter enclosure; licensed to September 1936. $750. M. C. Weir, care Airport, Tallahassee, Florida.

SPECIALS: Travel Air Sport Trainer, Wright Gipsy; Bird, 125 Kinner, 4-place; 1935 Aeromarine-powered Taylor Cub; 2-place side-by-side Kinner-powered Gee Bee biplane; Stinson S; 3-place Wasp-powered low-wing Buhl monoplane, high performance, many extras; OX-5 Command-Aire. Lowest prices! E. W. Wiggins Airways, Inc., Norwood, Massachusetts.

FOR SALE: J-5 four-place Stinson. Licensed to October 1, 1936. Hangar 33, Roosevelt Field. Hal Provo, 141-11 249th Street, Rosedale, L. I., N. Y. Laurelton 8-3977.

STINSON JR.: With Wasp Jr. engine, recently major overhauled and recovered. Also Type SD Wasp, now at factory for major overhaul. Weller Investment Company, Dunedin, Florida.

PRICED TO SELL OR EXCHANGE: 14 certified airplanes; J-5 Straightwing Waco, airwheels, many extras; J-6 B-5 6-place Ryan cabin ship, airwheels; J6-9 330 h.p. Travel Air cabin ship, full airwheels; J6-7 250 h.p. Straightwing Waco, airwheels, many extras; Cirrus 95 h.p. 2-place Driggs training ship; 2 Type 2000 OX-5 Travel Airs, airwheels; 1 OX-5 Curtiss Robin; 1 Continental A-40 powered Heath; 2 J-5 or J6-7 Pitcairns, with or without motors, many extras; 2 OX-5 Waco 90's; 1 J-5 B-1 Ryan 5-place cabin ship. Late model cars taken on deals. Terms to responsible buyers. Becker-Forner Flying Service, Inc., Jackson, Michigan.

AERONCA: Like new, special paint, lights, compass, air speed, brakes, streamline tires, heater, oil heater; $1,450 cash for quick disposal. J. C. Rolfe, 40 Jersey Avenue, New Brunswick, New Jersey.

FOR SALE: 1933 Continental Waco C. Total time 335 hours. Only 50 hours on engine since factory overhaul. Extra equipment: Lear radio, landing lights, electric starter and generator, bank and turn, rate of climb, and air brakes. Finish in good condition. Price $2,900. C. L. Burdick, duPont Building, Wilmington, Delaware.

FOR SALE: Stearman 80; sportsman pilot's personal ship; like new. Wasp Jr. 420 engine, Hamilton controllable pitch propeller, complete night and blind flying equipment, including both Sperry instruments, thermocouple and radio. Top speed approximately 180 m.p.h. This airplane as equipped cost approximately $18,000 new and will now be sacrificed at fraction of that figure. John Vette, 308 Forest Avenue, Oak Park, Illinois.

TAYLOR CUB: Like new; built June 1934. Total time, 130 hours. Licensed; privately owned; powered with Continental A-40-2. Equipped with winter enclosure. Price $950. Parrish Flying Service, Columbia, South Carolina.

WACO CABIN: 1931; licensed, excellent condition; wings recovered, fuselage refinished, motor overhauled. Many extras. $1,400 cash. Notes unacceptable. R. Ballmann, 3075 Victoria Boulevard, Cincinnati, Ohio.

SPECIAL, $900: J6-5 Travel Air 4000-E; air speed, starter, compass, reconditioned prop; new tires; condition fair. Tex Williams, Hangar 3, Floyd Bennett Airport, Brooklyn, New York.

TRAVEL AIR J-5: 3 POLB; total time 435 hours; since overhaul, 50 hours; complete, with standard instruments, landing lights, electric starter, speed ring, all white paint job. $1.200. William Miller, Floyd Bennett Field, Brooklyn, N. Y. NIghtingale 4-4200.

FOR SALE: J-5 Stearman in perfect condition, licensed to August 1936. $1,225. Will take plane in any condition in trade. Albert Grazioso, 647 Valley Road, Clifton, New Jersey.

CABIN MONOPLANE: 130 h.p. radial; 3-place; 39-foot tublar steel constructed wing; new covering; A-1 condition; registered; delivery guaranteed anywhere. 3312 Grand, Hunting Park, Calif.

FLEET: New engine. Front exhaust. All fine condition. Has hood and instruments; $1,500 cash. Bull Pup: Extra good condition. Newly covered; little time. $600 cash. Karl Voelter, Inc., All American Airport, Miami, Florida.

DE LUXE STINSON RELIANT: Year old; blind and night flying equipment. Total time, 500 hours. Motor and controllable propeller just majored by factory. Price, $4,800. E. F. Smith, Teterboro Airport, Hasbrouck Heights, N. J. Hasbrouck Heights 8-0747.

FOR SALE: Custom built Bellanca Skyrocket, $9,500. 145 Warner Fairchild 24, $3,000. 125 Warner Fairchild 24, $2,250. Fairchild 71, $2,250. Warner Aristocrat, $1,000. 210 Waco F-2, $2,000. Stinson Reliant, $3,500. Lambert Coupe, flaps, $2,500. J-5 Speedwing Travel Air, $1,150. J-5 Waco, Airwheels, $1,150. Aero Brokerage Service of New York, Roosevelt Field, Mineola, New York.

1933 CONTINENTAL WACO CABIN: 260 hours, none since overhaul; never cracked; very cheap. Jack Gillies, Aviation Country Club, Hicksville, L. I., New York.

OX-BIRD: Just relicensed October 1936. Excellent condition. Airwheels. Covering good condition. Red and silver. $550. Have room for ship, dead storage, very reasonable. Patchogue Airways, Patchogue, New York.

FAIRCHILD 21: Cylinder-faired Kinner, Heywood starter, brakes, duals, metal cockpit cover, instruments; licensed to May 1936. Privately owned. $975. All offers considered. R. Gabler, Main Line Airport, Paoli, Pennsylvania.

WACO F, KINNER B-5: 450 hours; five new heads, black with red wings, Heywood starter, baggage compartment, navigation lights; $1,700. Lambert Monocoupe: 355 hours; ship throughout in excellent condition, 8-day clock, steel propeller; motor factory rebuilt. Never damaged, always privately owned. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

WACO UEC CABIN: Late 1932. 210 Continental. De luxe job, beautifully finished hand rubbed gold and black, red stripe. Motor fully overhauled, modernized, about 100 hours ago. Radio, lights, electric flares, rate climb, compass, turn bank, special leather upholstering, 70-gallon tanks, pants, steel prop. other extras. Just relicensed. Price, $3,500. Individual, near Chicago. AERO DIGEST, Box 2183.

FOR SALE: Two Waco F's; Kinner B-5, excellent condition. Bank and turn, rate of climb, air speed, steel propeller, new windshields, air starter, 450 total hours, $1,600. Warner F, bank and turn, rate of climb, air speed, steel propeller, Townend ring. 550 total hours, $1,500. Both ships red fuselage, silver wings and tail group; linen excellent. Muncie Aviation Corporation, Muncie, Indiana.

WACO C: Late 1933; 210 Continental. Total time 235 hours, 35 since top overhaul. Equipped with starter, brakes, airwheels, pants, airbrakes, dual wheel, etc. Finished gray, with silver wings and like new in every respect. $3,000, for quick sale. Air Service, Inc., New Castle, Delaware.

TAYLOR CUB: Purchased September 1934. Perfect condition, 230 hours; winter enclosure. Licensed October '36. G. V. McGrath, Niagara Falls, New York.

FOR SALE: Waco "A", late '33 Jacobs, no time since major; radio, bank and turn. Heywood starter, wheel pants, speed ring, yellow fuselage, green wings, excellent condition. Price $2,650. Great Lakes 2T-1: Licensed September 1936; Airwheels, wings and tail surfaces just recovered; excellent condition. $950. Straightwing Waco: 175 h.p. Wright J-6; 15 hours since majored and modernized; electric starter, tail wheel, fuselage recovered high lustre finish; real buy, $1,250. John T. Corrodi, Box 185, Bexley Station, Columbus, Ohio.

AERONCAS: Late models; several ships factory reconditioned throughout. These ships are priced to move fast. For particulars, write Edwards Flying Service, Flushing Airport, Flushing, L. I., New York, or phone INdependence 3-4843.

J-5 PITCAIRN PA-6: Excellent condition. Motor just majored. Also 125 h.p. Warner Bird, fully equipped for radio and instrument flying. Sundorph Aeronautical Corp., Cleveland Airport, Cleveland, Ohio.

CLASSIFIED ADVERTISEMENTS

10c. Per Word; $2.50 Minimum. Payable in Advance.

PLANES and ENGINES FOR SALE

FOR IMMEDIATE SALE: OX-5 Swallow 3 POLB, just relicensed. 520 hours. Top overhauled 5 hours back; new prop, new spark plugs, new water pump, magnetos overhauled. Complete plane overhaul and recover, late 1932. Never cracked, always hangared. Good condition. $350. Le Roy Chadbourne, 14 Sutton Place South, New York, N. Y.

THREE TAYLOR CUBS: $750—$900. Two Aeroncas, $800, $900. One Curtiss Junior, $400. One Arrow Sport, $675. These airplanes are in A-1 shape and licensed. They may be purchased on a time payment plan. Wanted: Light planes for cash. Rochester Plane Finance, Airport, Rochester, N. Y.

FOR SALE: Jacobs cabin Waco; Stinson Reliants; Great Lakes; Bellanca Skyrocket and Pacemaker; Kinner Fleet; Warner Fairchild 24; Warner Fairchild 22; Lambert Monocoupe; Warner Monocoupe; Stinson S. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

180 H.P. HISSO E EAGLEROCK A-3: 250 hours total. Ideal for smoke-writing or sign towing; perfect condition; brakes, lights, Micarta prop. Licensed May '36. $525. Box 4, Robbins Hangar, Cleveland Airport, Cleveland, Ohio.

WACO 10: NC until July 1936. Refinished; airwheels, duals. In good shape, $350. Ray Henry, Sheridan Avenue, Warren, Ohio. Phone: 3540 L.

J-5 TRIMOTOR FORD: Electric starters, night flying equipment, new type seats with leather upholstering; condition A-1; licensed until October '36. Will consider J-5 Stearman or J-5 Waco on part trade. Price, $4,500. Finklea Brothers, Leland, Mississippi.

ARISTOCRAT: 125 h.p. Warner. Excellent condition. Price reasonable. George Rufle, 3285-33rd Street, Astoria, L. I., New York.

AERONCAS: Late models; several ships factory reconditioned throughout. These ships are priced to move fast. For particulars, write A. J. Leeward, Vandergrift Airport, New Kensington, Penna.

FOR SALE OR TRADE: Pitcairn Autogiro, powered with late 125 Kinner, complete with instruments and Heywood starter. Steel propeller. Beautiful condition. $1,200. Paul Rizzo, Floyd Bennett Field, Brooklyn, New York.

FOR SALE: Ryan 5-place J-5 monoplane, just relicensed, in A-1 condition. J. W. Esch, Vermilion, Ohio.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

FOR SALE: Dixie magneto switches, 49c; fuel pressure gauges, 47c; oil pressure gauges, 59c; engine priming pumps, 77c; distance temperature gauges, $1.98; Johns-Manville tachometers, $5.87; booster magnetos, $4.95; Star Pathfinder compasses, $12.87. Send dime for catalog full of other bargains. Karl Ort, 612 W. Poplar St., York, Penna.

HISSO 150, 180 and 300-360 engines and parts at ridiculously low prices. These make excellent speed boat engines when converted. Write for quotations on your requirements. Karl Ort, 613 W. Poplar Street, York, Pennsylvania.

WAR RELICS for clubhouse or den. Vickers aircraft machine guns; cost government $700; rendered unserviceable, without marring. Only $7.75 each, f.o.b. New York. Sent C.O.D. on payment of $1. Weight 33 pounds. Fiala Outfits, 47 Warren Street, New York, N. Y.

FOR SALE: New left Robin panel, $80. Pair used Robin panels, uncovered, $45 each. Challenger Robin motor mount, $15. DH Moth axles, $7.50. OX Robin axles, $5. Travel Air 2000 axles, $5. Used 300 Cessna right axle, $8. Used 300 Cessna oleo strut, $8. Gardner Cirrus wood propeller, $10. Used Pioneer turn and bank, $45. Pioneer rate of climb, $35. Used K-5 pistons, $3. Used Challenger cylinders, $6. Used J-5 cylinder, complete, $15. Pioneer altimeter, $12. Also a few used and new Robin, Fledgling, Moth, J-5, K-5, and Challenger parts at substantial discounts. Write us. Baltimore Flying Service, Inc., Baltimore, Maryland.

FOR SALE: 2000 Travel Air parts; OX-5 Scintilla magneto, not used since overhauled. Hamilton metal prop. Miller overhead. Charles Esselstrom, Box 197, Virginia, Minnesota.

BIRD: Factory built spare and component parts. Rebuilt 125 Kinner Bird, ready for dope, less motor; new parts used, three wings, motor mount, landing gear, gas tank, turtle deck, $750. Kinner K-5 motor, less cylinder heads, late model, excellent condition. Fleet landing gear, struts, ailerons and other parts reasonable. Approved Station No. 254. Speed Bird Corporation, Keyport, New Jersey.

STINSON RELIANT: Total time 575 hours, motor just overhauled; fully equipped, including radio, $3,750. J-5 Stearman, beautiful condition, $1,650. Challenger Robin, $900. Avian, $675. OX-5 Waco, $450. Harry R. Playford, Inc., Municipal Airport, Cleveland, Ohio.

J-5 CYLINDERS: $10 each; J-6 cylinders, $25 each; PN-5 magnetos, $15 each; K-5 Kinner case, $40; J6-5 crankshaft assembly with master and art. rods, $75; J6-5 main case, $50. All parts reconditioned. General Airmotive, Municipal Airport, Cleveland, Ohio.

USED VELIE PARTS: Cylinders with valves, $10 each; main case, $20; gear-case and rear cover, complete, $15; master rod with connecting rods, $20; push rods, 25c each; pistons with wrist pins, $2 each; set new Power Seal rings, $3; set short stacks, $2; oil sump, $1.50; carburetor adapter, 75c; set intake tubes, $2.50; Stromberg carburetor, $20. M. Emling, 1527 Bewick Avenue, Detroit, Michigan.

3-CYLINDER LATE 45 h.p. Szekely engine, completely overhauled. Airwheels, 16x7. Klemm wings and tail surfaces, landing gear and oil struts. Edward Anderson, 60-47 Saunders Street, Elmhurst, New York.

J-5 MOTOR: Less main case; excellent condition; sell all or any part very reasonably. Also Travel Air 2000 parts, OX-5 motors, and instruments. Carl V. Seltzer, R. D. 1, Vestal, New York.

FOR SALE: Westport remote control radio; complete 6 tubes, phones, battery and antenna. $35. H. W. Bresee, 650 S. Salina St., Syracuse, N. Y.

SAVOIA-MARCHETTI S-56-B: Crack-up; all parts: right wings, tail assembly, landing gear, instruments, wobble pump, etc. What do you need? Sacrifice prices. AERO DIGEST, Box 2170.

FOR SALE: At closing out bargain prices: J6-5 175 h.p. Wright motor, $325; J-4 220 h.p. motor, $195; J6-7 250 h.p. Wright motor, $575; nearly new J6-9 330 h.p. Wright motor, just major overhauled, $850; J6-9-E Wright motor, no time since overhaul, priced on request; J6-7-E 250 h.p. Wright motor, priced on request; brand new 22 x 10 x 4 Goodyear full Airwheels, including new hubs, $35 each. Steel propellers for above motors priced on request. All Warner and Wright motor parts, 60% to 80% off. B-1 five-place Ryan cabin ship, less J-5 motor, $675. We are closing out. Write or wire your needs. Michigan Aero Motors, Jackson, Michigan.

COMPLETE SET WACO Cabin 1933 wings, with tanks. Great Lakes center section tank. Any reasonable offer, or trade. Charles Koster, 483 Fourteenth Street, Brooklyn, New York.

ALEXANDER FLYABOUT: Less motor. Best offer, quick. Also Szekely parts and orop. P. Green. Hangar 3, Floyd Bennett Field, Brooklyn, New York.

J-5 ENGINE: 80 hours since major overhaul, $365; Pioneer turn and bank, large type, $45; J-6 Standard steel prop, 20 hours since factory reconditioning, $75; radio receiver, $45; Trimm headphones, new, $3.50; pistol and two flares, $37.50; new 14 x 3 tire, $4.50; Waco F lower aileron, $7.50; 3-blade Standard steel propeller; Velie Cavalier, uncovered, motor down, as is, $185. OX-5 Eaglerock; Cirrus parts. C. R. Nuckols, Box 53, Oklahoma City, Okla.

LOT OF PARTS for 1820-F Cyclone, Wasp and Hornet motors. Cylinders, crankcases, pistons, etc. New Wasp exhaust valves, $5. Wanted: Set of Wasp D cylinders. Crawford Airplane Supply Company, 350 Washington Blvd., Venice, California.

RECONDITIONED WARNER cylinders with valves and rockers; J-6 parts, new and used; Wasp parts, wobble pumps; Bendix brake assemblies; pressure fire extinguishers. Want Waco F or Fleet, cracked or needing overhaul. AERO DIGEST, Box 2178.

THREE USED J-5 and J-6 speed rings, $18 each; many other used speed and exhaust rings. Engel Aircraft Specialties, Glendale, California.

TWO SCINTILLA PN5D magnetos, $20 each. Stromberg NAR3 carburetor, cost $19 to factory overhaul, $25. Velie M-5 parts and Monoprep tail and ailerons. Cheap. Bob Gilfert, Tamaqua, Penna.

ENGINES: Major overhauled and in excellent condition. OX-5, OXX-6, American Cirrus, English Cirrus. Stock of parts for Kinner K-5, American and English Cirrus. Lester J. Sipe, Box 118, York, Pennsylvania.

AIRWHEELS: 22 x 10-4 Timken bearing hubs and complete with adapters. One pair, $37.50. Another pair, complete but tires not so good, $30. Avro Avian landing gear, tail surfaces, etc. Lester J. Sipe, Box 118, York, Pennsylvania.

USED PARTS for Waco F and Warner motor: Instruments; air starter. Write for quotations on your needs. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

FOR SALE: Travel Air parts; Swallow TP crack-up, less motor, $65. Crack-ups rebuilt; recover jobs a specialty. OX valve seats and guides installed for 85c each. Want: Hisso E motor and detachable motor mount for Travel Air 4000; OX Challenger, right upper and left lower wings and tail group; OX propeller. Tiffin Flying Service, Tiffin, Ohio.

J-5 MOTORS: Two, no time since major. Used J-5 parts. Make offer. Will pay cash for your airplane. Write or wire R. C. Downing, South Side Station, Springfield, Missouri.

AIRWHEELS: New Goodyears, 22 x 10-4, complete with internal brakes, less tires. Best reasonable offer. Pioneer landing lights, including 12-V bulbs, $15 pair. A. G. Becker, Dravosburg, Pennsylvania.

ENGINES FOR SALE: Continental 165 h.p., little time. J-5 No. 9355, majored. J6-5 with new prop. Axelson B-7, new with new prop. New American Cirrus. Engine parts: Challenger crankcase and parts. Cirrus cylinder, pistons, crankshaft oil pump, mags. Lambert cylinders, pistons. J-5 hub and parts. Warner pistons. Velie parts. Airplane parts: Great Lakes ailerons, wing struts, landing gear parts, wing fittings, elevators. Stinson 6-place landing gear, motor mount. Waco 10 upper wings, landing gear, V-struts, ailerons, wing fittings, struts. Travel Air 2000 wings and wing fittings, center section. V. L. Olmstead, 2918 Benton Boulevard, Kansas City, Missouri.

ENGLISH GYPSY MOTH: Fine condition, always well maintained; red and black; wood propeller, slots, compass, phone installation. Licensed, July 1936. $625 cash, no trades. Vicinity Chicago. AERO DIGEST, Box 2184.

CLEARANCE SALE OF WINGS: Wacos 10, J-5, F; Travel Air 2000; American Eagle; Swallow 3-place. Spars, ribs, covers made to order. Special on dope. N. L. Aircraft Co., Vermilion, Ohio.

WANTED TO BUY OR TRADE

WANTED: Inverted Cirrus, upright Cirrus, Wright Gipsy or English Gipsy. State exact condition and lowest price to General Airmotive, Cleveland Airport, Cleveland, Ohio.

$25,000 CASH waiting for your used engines, parts, crack-ups, instruments, airwheels and starters. We pay up to $500 for Warner, Kinner and Lambert engines. AERO DIGEST, Box 2165.

WANTED: Two or three-place plane under $500, cash. State full information in first letter. Wilson G. Oswald, 1103 Marlboro St., Sandusky, Ohio.

WILL TRADE dandy OX-5 Swallow T.P. Has Airwheels, air speed, exhaust stacks under wing. For good Monocoupe, Star Cavalier, Travel Air, Waco, Eaglerock, Robin or similar job. W. V. Spahr, Minneola, Kansas.

WANT TO TRADE: OX-5 American Eagle, licensed to August 1936, for 2-place Aeronca. State shape, proposition. M. Massini, 418 Main Street, Old Forge, Pennsylvania.

WANTED: One complete set of Waco 10 landing gears, with oleo struts. Have to sell straight axle gear, licensed on Waco 9 or Waco 10. Howard Stevens, 3705 Woodbine Avenue, Baltimore, Md.

SPOT CASH PAID for your airplane, motors or parts. Give full information in first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

WANTED FOR CASH: Used airplanes and parts, engines, propellers and instruments. Give details and price in first letter. Floyd Terrell, 3763 Keys, Grand Rapids, Michigan.

CLASSIFIED ADVERTISEMENTS

10c. Per Word; $2.50 Minimum. Payable in Advance.

● WANTED TO BUY OR TRADE

WANTED: Light planes, cracked or in need of repair. State full particulars first letter. M. N. Brann, Vesper Street, South Hempstead, New York.

WANTED: Argo, with or without motor. Any condition. Charles A. Lutz, Lebanon, Ohio.

CASH PAID for airplanes, engines and parts. Want instruments, steel propellers and air wheels. State full particulars and price in first letter. Floyd Becker, Aberdeen Rd., S. E., Grand Rapids, Mich.

LARGE CHOICE repossessed cars. No junk. Trade for licensed planes and pay cash difference. Fly to Hemlock Airport. See them. Aviation Finance Co., Hemlock, New York.

WANTED: Lambert Monocoupe. Must be in A-1 condition and priced right for cash. Give complete description and history in first letter. Howard Sauls, Saltville, Virginia.

WANTED: Wright J-5 and Szekely; either parts or as-is engines, to build up. P. O. Box 423, Burbank, California.

WANTED: Waco "F" parts for cash. For sale: J-5 standard used pistons, $1 each; J-5 hardened steel exhaust valve guides; J-5 reconditioned cylinders, and new oversized pistons. Wasp C parts. Skyways, Inc., Municipal Airport, Cleveland, Ohio.

WANTED: Bird landing gear parts for OX-5 job. S. K. Creel, Parkersburg, West Virginia.

WANTED: Salmson 40 h.p. engine. Will pay cash; write to J. Thomson, Cleveland Avenue, Hasbrouck Heights, New Jersey.

WANTED AT ONCE: 10 airplanes for cash, regardless of condition. Give full information in first letter. Glenn Fellows, Box 66, Jackson, Michigan.

WANTED TO BUY: Waco F-5 or F-3. Must be in first class condition and priced right. Altoona Aviation Corp., 2503 Union Avenue, Altoona, Penna.

WILL TRADE Minnesota summer resort, five housekeeping cabins, ice house, five acres; 30 miles northeast of Twin Cities, for late model cabin ship. William Bruggeman, 855 Deppe Street, West St. Paul, Minnesota.

WANTED: Three- or four-place Kinner Bird, preferably one needing complete overhaul. Must be cheap. State all details in first letter. A. G. Becker, Dravosburg, Pennsylvania.

WANTED: One Lycoming Stinson, less motor. St. Louis Flying Service, Inc., Lambert Field, Robertson, Missouri.

● PARACHUTES FOR SALE

PARACHUTE SCHOOL: Instruction in jumping by Government licensed parachute expert. Army methods. Parachute sales and service. Used chutes for sale. Sherwood Cole, Central Jersey Airport, Hightstown, New Jersey.

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**CLASSIFIED CLOSING DATE:
NOVEMBER 18th**

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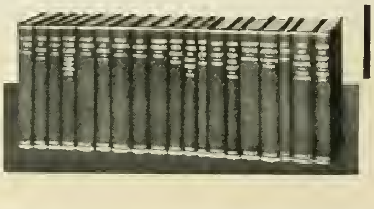

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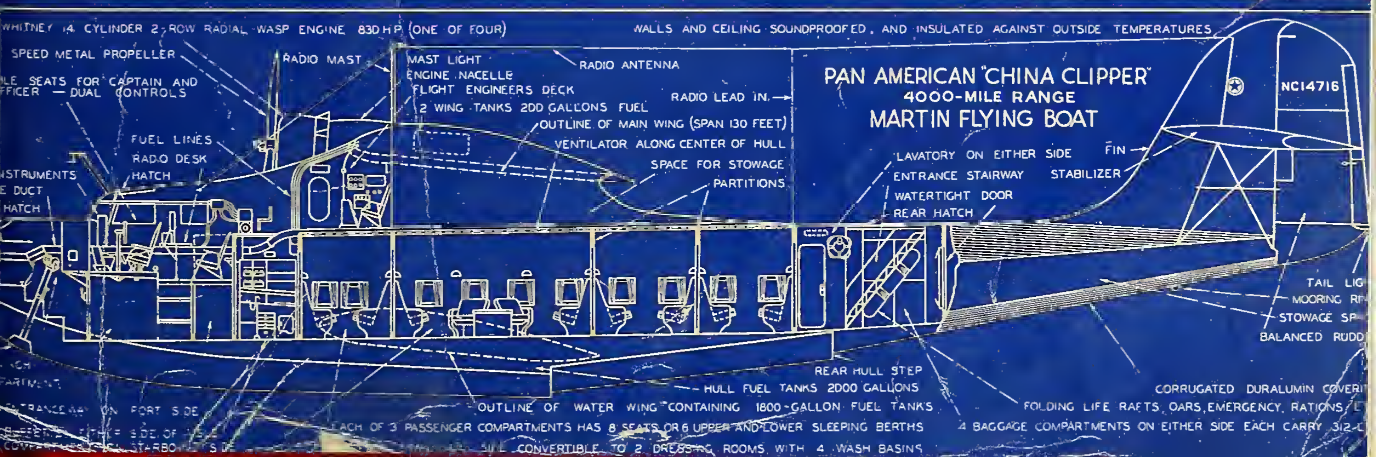
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Volume 27. *Number 6*

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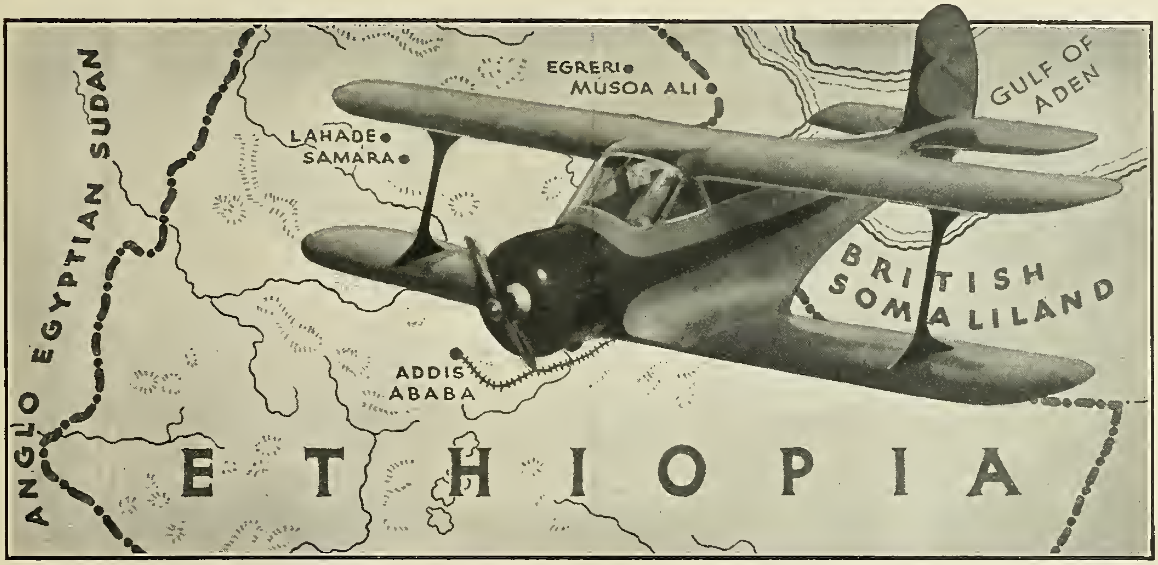
B17L OVER ETHIOPIA»



and even Haile Selassie goes Air Minded!

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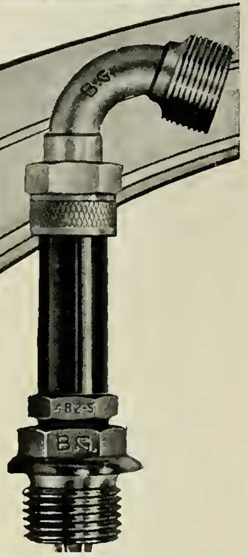

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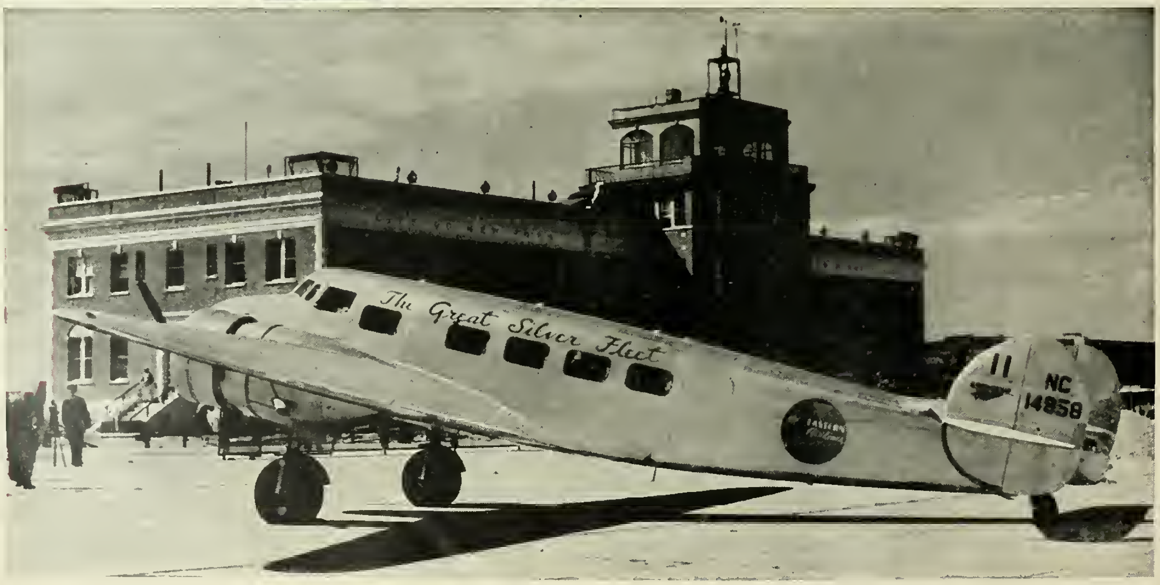

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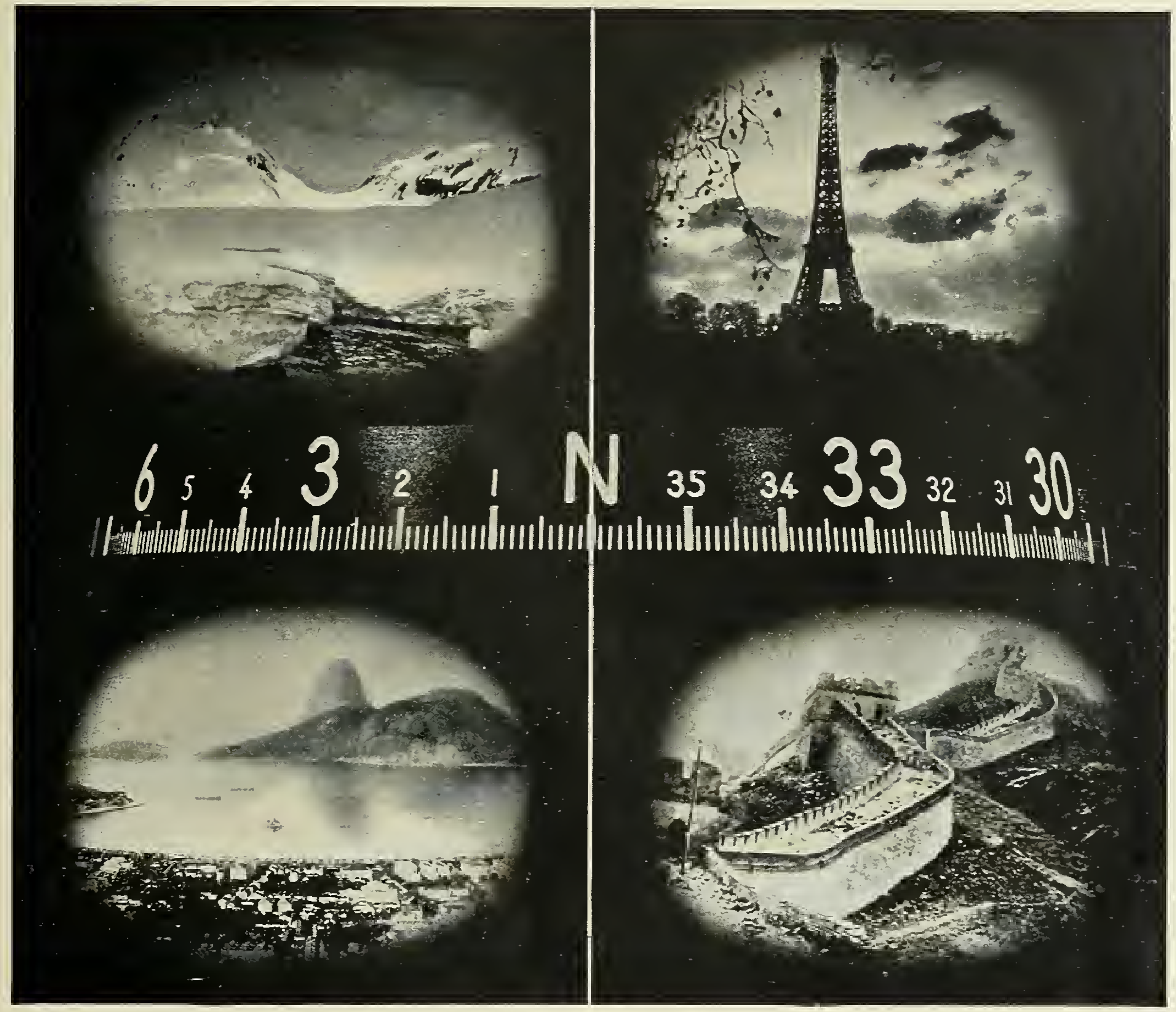

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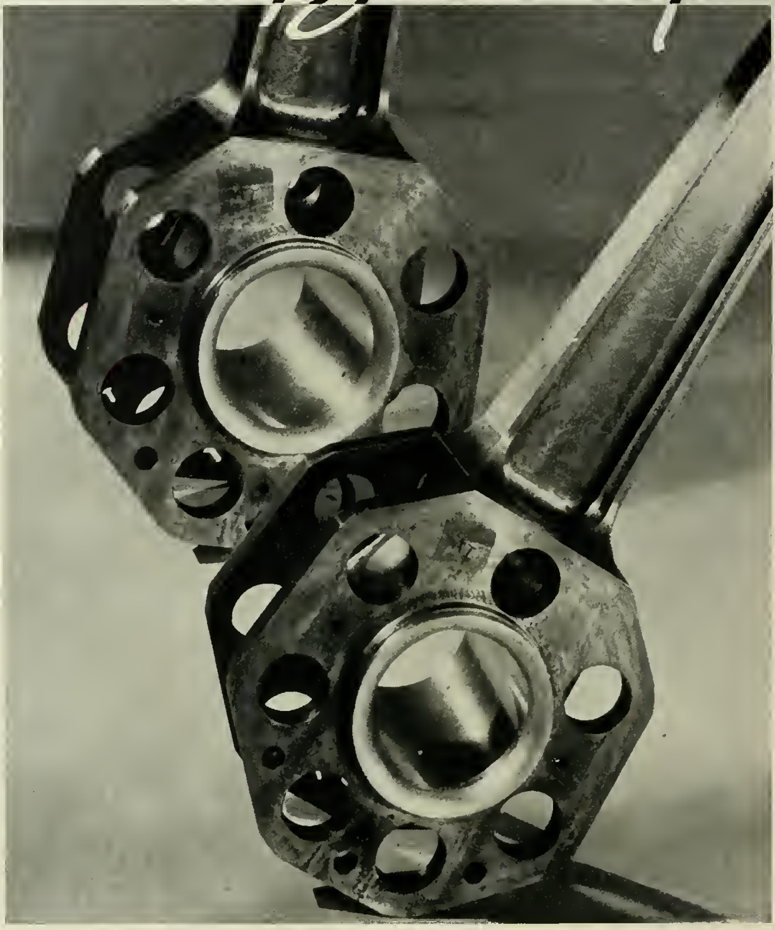
Once there lived in a Pratt-Whitney Wasp C Motor, No. 4105, a master rod bearing. This bearing, lubricated by a nationally advertised, high priced brand of oil, flew about the country in a Bellanca plane. After 250 hours of air travel, the Bellanca stopped at the United Airport, Burbank, California, on February 19th, 1935, so Pacific Airmotive Shops could overhaul the Wasp Motor. The master rod bearing was thrown away because it was worn six-thousandths [.006] of an inch.

CHAPTER 2: *(February 24, 1935)*
The Wasp motor was re-assembled with a new master rod bearing (set at a clearance of 2.6858 of an inch). This time Macmillan Ring-free Motor Oil was put in the motor and the Bellanca flew on its way.

CHAPTER 3: *(September 27, 1935)*
Seven months later, after 371 hours in the air, the Bellanca again came to rest at the United Airport so that Pacific Airmotive Shops could once more overhaul the motor. Everyone knew that 371 air hours were longer than the motor is normally flown between overhauls. And so, the motor parts were micrometered carefully. The second master rod bearing showed a clearance this time of 2.686", or wear of only two ten-thousandths [.0002] of an inch. The Wasp motor was re-assembled and is today flying about its business with No. 2 master rod bearing again in its place around the crankshaft.

P. S. The cylinders showed a uniform wear for the 371 air hours of .0005 of an inch. The piston rings were clear of carbon and free in their grooves. No parts were replaced on account of wear.



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Capt. Albert W. Stevens and Capt. Orvil A. Anderson, Commander and Pilot respectively of the stratosphere balloon, warmly attired as they stand in front of their gondola just before taking off on their record-making flight.

WIDE WORLD

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Acme photo

Four of the Forty Martin B-12 Bombers in the U. S. Army's GHQ Air Force

AIR
HOT AND OTHE

And Now Comes Vidal's Radio

FRANK A. TICHENOR

● Woe unto poor old Ringling Brothers Barnum and Bailey circus! They used to have "The Greatest Show on Earth". But Vidal has stolen their thunder.

The Director of Air Commerce has shattered all records for standing on his head. It's an astounding

the land by issuing this order prohibiting use of the airways to all save one single class of traffic? What insolence—when the Act of Congress which provide the construction of these very specifically states that their us

● The Caesarian operation by which that feeble old woman of the air, the United States Army Air Corps, was delivered of the infant General Headquarters Air Force, was quite successful, and mother and child are doing as well as could be expected. The infant, however, is rather weak and puling, and at present is suffering from undernourishment and the rickets.

If we became embroiled in a war tomorrow, the U. S. Army's GHQ Air Force would have just 165 modern fighting planes with which to defend us. Allowing that none of them are in the workshops for repairs or engine changes, that works out to only one modern airplane to defend 800,000 trusting citizens—or one to each 22,657 square miles of territory in the United States and its possessions. Quite a task for one airplane!

By modern planes, I mean those that are not more than about three years old. All others are obsolete or obsolescent. I arrive at this definition of "modern" by the simple process of comparing the age of service aircraft with the age of aircraft now in operation over our principal commercial airways. There are no transport planes more than two or three years old operating on any major American airline today. If our commercial airlines were asked to operate transport planes of a vintage comparable to the great majority of service planes now in use in the GHQ Air Force, they would give up in despair. They simply could not operate any more than the Air Force could operate its old equipment in a modern war.

In modern equipment the Air Force has 40 Martin B10 and B12 bombers; 35 Curtiss A12 attack planes; and 90 Boeing P26A pursuit planes—165 modern war planes, all told. There also are 10 modern Bellanca cargo carriers, but they are not fighting craft. The total of all airplanes in the GHQ Air Force, including the above, and obsolescent and obsolete types, and some training types for blind flying purposes, is 360. Though all are useful for training, it must be borne in mind that none could be used in war except the 165 first mentioned. To send our officers up to fight in that other obsolete equipment is to sentence them to death—and they know it.

The figures given are of course approximate; the number varies from week to week, due to crashes and planes withdrawn from service due to faults in design and manufacture which make themselves known after the planes have been in service. For instance, there was trouble with the Martin bombers, which were grounded for a time. At low speeds there was a tail flutter which it was feared might lead to fatigue of the metal and consequent fracture. This has been partly though not entirely overcome in the new type by the use of "eyebrows," which have reduced the speed of the machines several m.p.h. Thus it is clear that when I state that the Air Force has 165 modern planes, I am including many that were not always available.

To fly this equipment, old and new, faultless and faulty, there are in the Air Force at the present time approximately 350 regular officers, 140 reserve officers, 130 flying cadets, and 15 enlisted pilots—a total of 635 pilots. Most of this number have insufficient time to devote to flying and to gaining practice in their profession. In the first place, there are not nearly enough planes for them to fly; and in the second place, the senior officers find themselves limited in flying because of their other duties of executive work, paper work, and general Army baloney. The senior officers are practically glorified clerks, spending hours of their working day at desks, grinding out bales of reports. The airplanes are underworked, according to commercial standards, and the typewriters and pens and pencils are working overtime. This condition—unavoidable under the present Army set-up—explains in part why the Army made such a deplorable exhibition when it attempted to fly the air mail or to bomb the elusive *Mount Shasta.*

As the GHQ Air Force is just getting started, it might appear ungracious to criticize it so early in its life. But this paltry collection of new and old planes, and new and old pilots, is ALL the fighting force that the hampered Air Corps has been able to produce in 15 years of Army misadministration, wasting of funds, procurement of ineffective equipment and general loafing and boondoggling on the job of national defense. This feeble beginning of what we hope wistfully will become modern air power, is the best that the U. S. Army and its collective intelligence has been able to give the taxpayers who have groaned and footed the defense bill for a decade and a half. And so far as I can see, the progress of the next 15 years under the same snail-minded guidance will be effected at a speed no greater than that of the progress already made. The same men are on the job, and the same earthbound viewpoint continues to prevail in the General Staff and in the Army Air Corps. This is not to state that Army officers are unintelligent, for mentally they compare favorably with major and minor executives in civilian business. But they are not permitted to exercise their intelligence as air officers. Collectively they are forced by the Army system to adhere to a viewpoint which belittles the role of air power in war and exalts the Infantry to the skies as the Queen of Battles. That is what is wrong with the Army Air Corps and the GHQ Air Force; and it is very nearly all that is wrong with them. It will be corrected only by divorcing the Air from control by the Earthbound.

I have been told by more than one high ranking officer that my previous article was not favorably received by some in the Air Corps. They stated that they were satisfied with the GHQ Air Force and thought that it should be given time to work out. I replied that it would work out only a little better than the old set-up had worked out; for it was working under the same general handicaps, with the further handicap of divided command between the procurement and training services, the Air *Corps;* and the fighting service, the Air *Force.*

The Air Corps, including (1) the Air Force under General Andrews and the War Department, and (2) the Training, Administrative, Supply and Engineering Departments under the Chief of Air Corps and the War Department should be administered under one head who knows the business. Now it *is* under one head, the head of the War Department, who knows practically nothing of air problems! It should be under one *air* head, in a set-up where one group is not jealous of the other.

The efficiency of our national defense and the effectiveness of our air defense is being jeopardized by the ignorance and prejudice of ground officers of the War Department, who are in control.

This Air Force experiment, although it is a faltering step in the right direction, is not new or original. It is merely an enlarged copy of the discarded English plan of 1917, when General Trenchard was given command of the Royal Flying Corps' Independent Air Force, which was thenceforth permitted to work independently of the RFC. This old British experiment of 18 years ago gave our General Staff the idea. The English, of course, soon improved upon this by forming the Royal Air Force in April, 1918.

We are now some 18 years behind the British in our flying organization, and my general conclusion is that this present GHQ Air Force was devised by the General Staff largely for propaganda purposes. All other important nations have Air Forces, so it seemed expedient to *pretend* that we also have an Air Force. Actually, we have nothing of the sort; we have 165 modern fighting planes, and no more. And it is a damning indictment of the 15 years' control by the War Department to face the fact that, after all the expenditures, we have no more than 165 modern planes.

The fact is that the general dissatisfaction in the Air Corps and the reports of the various investigating committees has brought home forcibly to the War Department the necessity of doing *something* to make the citizens believe that they are adequately protected in the air, which they certainly are not. The present GHQ Air Force is the answer to that necessity. It sounds all right when you read about it in the newspapers, but when analyzed, it shows nothing but a strong wind and a few airplanes.

Feeling that there was nothing basically wrong with my previous article on the air force, I naturally wondered if there might not be something wrong with the viewpoint of those senior officers who so earnestly tried to disagree with me—probably lest they be court martialed for treason to the Infantry, Cavalry and Artillery. I investigated and found out what was wrong with them—they know the philosophy of the ground army; they are old Army men who, after becoming air-minded, have now become safety-minded. And here is how that has come about.

The first World War built up a real morale and a belief in the future of air power in the minds of these old-timers as well as the youngsters who joined the new branch. In their enthusiasm they began to tell the world what they could do and how good they were. To prove some of it they sank the German warships off Cape Hatteras when the Navy, almost to a man, said it couldn't be done. Then, looking around the world and seeing air power everywhere being separated from ground control, they dared hint that maybe the Air Corps would be better off if it were taken away from control of the War Department. That was when things began to happen. The Pooh Bahs of the General Staff went into action to scotch this growing menace to ground control. After the assassination of General William Mitchell and the banishment of Major, now Lieut. Col. Arnold to St. Helena and points west, the Air Corps officers became safety-minded. They had learned that to speak out in favor of air power was to invite being kicked out of the Army or to be denied promotion. But that isn't all.

At a professionally critical period in their lives they have it forcibly brought home to them that if they are to progress any further in the Army or the Army Air Corps, they must graduate from the Command and General Staff School at Fort Leavenworth, Kans. Unless they do that they have absolutely no chance for further advancement in the Army or the Air Corps. That was and still is the policy.

Now, this school is purely a ground school. Even at the Air Corps Tactical School the officer discovers to his surprise that besides learning Air Force tactical and strategical employment, he has to spend nearly 40 percent of his time learning to be a ground officer educated to command ground troops! He is being prepared to be an air officer, but in addition he is being stuffed with knowledge that will enable him to become a pupil in the Command and General Staff School, whose course has to do almost entirely with ground work and the employment of ground armies.

At Leavenworth, in short, he merely learns about the General Staff and *how to get on it himself*. So far as the employment of air force is concerned, he might just as well attend a course in criminology at the nearby Penitentiary. In fact if he was sentenced to a quiet cell at Leavenworth he might become a better air officer; for with no distractions he would have time to think about air power, and perhaps might emerge with some progressive air ideas. As it is, he plugs through the ground course, follows the sign-boards, and gets his degree. The main thing that he has been taught is that the Infantry is the Queen of Battles—and God help him and his career in the Army if he dares to dispute it or even seems to doubt it! Is it any wonder, therefore, that these senior officers cannot admit that they agree with me?

Under the present set-up, which was recommended by the War Department-appointed Baker Board, the Army Air Corps and the Air Force are separate, though both come under the control of the General Staff, a *ground* organization with a few advising air officers. The whole thing is controlled by officers whose life work is on the ground, and on the ground only; many of them have never even had a ride in an airplane, and hardly any of them are pilots.

Now, the only fighting force in the air is the Air Force, and that is under the command of a Brigadier General. He has no real undisputed command of the forces under him, for the training of those forces, and the procurement of all flying equipment comes within the sole province of the Air Corps. And the Air Corps is commanded by a Major General, who can tell a mere Brigadier General to go back and sit down and not speak up loudly in the class! Thus we have the amazing fact that training and procurement are deemed to be far more important than the actual fighting—which is what all air power is assembled for! Procurement, after all, is the work of an equipment officer, who may or may not know anything about fighting. Training, like procurement, is important, of course. But what sort of reasoning is this which claims that training and procurement are more important, and require the control of an officer who is superior in rank to the officer who directs the use of our Air Force in war? In fact, it seems to me that there is no reason, other than the jealousy of the ground officers in the General Staff, why Brigadier General

(*Continued on page 70*)

AIR
HOT AND OTHERWISE

And Now Comes Vidal's Radio Fiasco!

●

FRANK A. TICHENOR

● Woe unto poor old Ringling Brothers Barnum and Bailey circus! They used to have "The Greatest Show on Earth". But Vidal has stolen their thunder.

The Director of Air Commerce has shattered all records for standing on his head. It's an astounding performance, but it doesn't do aviation one whit of good. It might not be so bad if Mr. Vidal didn't keep trying to stand aviation on its head too, to keep him company. Such antics may be natural for the Director—what is it the evolutionists call it, reversion to type?—but it's causing a dangerous rush of blood to the head of the aeronautic industry.

The latest of Mr. Vidal's hand-stands is his most perfect example to date of doing things upside down. Some demonic impulse seized him and he threw all private and miscellaneous commercial pilots off the airways during bad weather. His excuse was that he was saving lives—that a very dangerous situation had developed because ships of all kinds were barging up and down the radio beacons without knowledge of each other's whereabouts.

Now, nobody who knows anything at all about flying as it is done today will deny that there is a difficult problem to be solved in controlling air traffic, particularly on congested routes and in the vicinity of busy air terminals. Revised regulations of some kind are most assuredly needed to meet changing conditions. But why do the job backwards? Why in heaven's name ground everybody first and then devise new regulations later? That's about as asinine as following the advice of the dunderhead who suggested that what we need is absolute safety in flying and that the way to achieve it is to stop flying!

But this thing really cuts deeper than that. It's not merely a matter of pulling a boner. Nor is it just a case of botching the job. Those are simple things—common human fallibilities. This is far worse. It is bald autocracy. It is the arrogance of bureaucracy run wild. It is the nullification of inviolable rights by a petty official who has constituted himself a demi-god, above the authority of the Constitution, the Congress, the whole citizenry of the United States of America.

Where else, how else, did this man get the authority to violate the written law of the land by issuing this order prohibiting use of the airways to all save one single class of traffic? What insolence—when the Act of Congress which provides for the construction of these very airways specifically states that their use shall not be limited to any class or classes of aircraft!

Possibly we should be accustomed by this time to such cheek on the part of a bureaucrat. It's the bad blood of the New Deal and it runs in the veins of nearly every official in Washington these days. Not content merely to perform the duties of their offices, and keep their own domestic affairs in order, the whole tribe of them seem to think they have to take care of the affairs of every citizen in the land. Judging from the way they act, they think they are the chosen people—the only people in the country who have been endowed with brains. Everybody else is too dumb to know what he's doing or too crooked to be trusted. So the New Deal must set itself up as everyone's parent and guardian, and lead us all by the hand along the tortuous paths, not only of our own businesses, but of our private lives as well.

Many a political sin hides behind this "you-don't-know-what's-good-for-you" verbiage. If Vidal had been keeping his own house in order, he would never have had to dodge behind this subterfuge, because he never would have issued that edict on airway flying in the first place. For if there were any semblance of efficiency and cooperation within the Bureau of Air Commerce, the situation would never have gotten out of hand as it did.

Nothing—not even the $700 airplane fiasco—has revealed so strikingly what a state of turmoil exists in the Bureau today. At the time the order was issued, according to our understanding, neither the regulations division nor the airways division knew anything about it. It came as a thunderbolt to both. Yet obviously the matter of airway facilities and how they shall be used directly affects each division. Such lack of coordination might be understandable if this thing had come as a sudden crisis and action had to be taken overnight to avert rampant death and destruction.

But there was no emergency. The Bureau of Air Commerce has been aware for many months that a congested condition was developing along the airways. It has had ample time to study the situation and search for a solution. It has had every opportunity to bring together the heads of all departments affected so that each could diagnose the ailment as it appertained to his own division and suggest remedies which, in turn, could be coordinated with the correctives offered by other divisions.

That would have been the logical, sensible way to have handled the problem. But it was not the Bureau's way. Oh, no—the Director wouldn't have gotten his name in the papers that way. That's the kind of a job that is done quietly behind the scenes. It's the kind of a job that is more important for the good it accomplishes than for the splash it makes. And it's the way the job is going to have to be done in the end anyway.

Loose-jointed methods won't work here. Ordinarily Gene Vidal may be able to dance his own little jig over his $700 airplane, while Carroll Cone tends to his knitting on regulations and Rex Martin sews and mends his airway facilities. But here is a case in which they must all work together, or not at all. Every class of heavier-than-air craft in existence plays a part in this picture. Nearly every grade of pilot. Certainly every aid to air navigation, both Government and private-operated. Even the Army and Navy figure in, now that they're doing so much instrument flying.

If there is going to be traffic control, it must be unified control coordinating all elements. This situation which gave Mr. Vidal the jitters is not the fault of the pilots who fly the airways in bad weather; it cannot be attributed to promiscuous intentional instrument flying in poor visibility. It is largely nothing more than a complete failure on the part of the Department of Commerce to adjust its own aids to air navigation to the changed conditions brought about by the inevitable growth of instrument flying. It is a failure to coordinate the radio communication system for miscellaneous fliers with that of the air transport lines.

It is utterly absurd to attempt to draft regulations governing instrument flying until those things are done. It is doing the job backwards, upside down. Putting on the Greatest Show on Earth perhaps—but at what a price to aviation!

FLIGHT LOG

●

P. T. W. SCOTT

. Pilot, Transcontinental & Western Air, Inc. .

● In a previous article we discussed the need for a preliminary flight plan; its make-up and use. Once the flight is started, however, definite data in some kind of a flight log must be kept so that the pilot may check his actual progress against the anticipated, and as soon as possible establish the flight on an actual, instead of a theoretical basis.

Pilots usually keep something in the nature of a flight log, although they are not always aware of doing so. The data may be in the form of mental or scribbled notes. On flights out of sight of familiar territory, a well-kept flight log is of inestimable value. Since much of the present-day flying is accomplished without sight of the ground, accurate navigation must be possible without relying on the pilot's familiarity with the route, although knowledge of the route is an invaluable asset.

It is largely the reliability of radio navigational aids that has made possible the advance from contact flying to the present form of aerial navigation, but following the proper course as indicated by radio, is not enough, for in the event of radio failure the pilot is left with no other mechanical aid. The airline pilot, on the other hand, must at all times know where he is, his speed, fuel consumption, his arrival time, and what wind to allow for if it becomes necessary to dead-reckon his course without his radio.

Knowledge of his position is more important to the pilot out of sight of the ground than it is to the contact flyer, for in addition to knowing which way to go in the rare event of mechanical difficulty, or in unforeseen weather changes, the airline pilot must be able to radio an accurate position report so that danger of collision with another flight will be minimized.

Performance as relating to speed, drift and fuel consumption is important. First, the pilot must have a check on his preliminary estimate, to determine whether his arrival time will be within the expected fuel limit, and whether it will be on schedule. If he finds that his performance is not up to expectations, he will be able to adjust his percent power and altitude to best fit the circumstances. Accurate performance figures will modify the wind aloft data of the basic flight plan, and may indicate that a different cruising altitude is desirable. In the event that it becomes necessary to proceed to an alternate field, he can, if necessary, plan a dead-reckoned course from his estimated position on the basis of his own wind aloft calculations. Similarly, in the event of temporary or permanent radio failure, he can accurately proceed solely by dead reckoning. Fuel consumption at present can only be determined accurately by the amount of time it takes to drain one tank dry, but the percent power figure, on the basis of past experience, immediately gives a good estimate.

The time of arrival at a definite destination, in addition to being important from a standpoint of making schedule, assumes a new importance due to the increasing care which must be taken in controlling traffic at major fields or terminals. Where several planes are approaching on instruments, or on top, at a terminal, and ceiling and visibility conditions are poor, close estimates of arrival are most necessary, since they permit the airport control tower operator to bring the transports in with a minimum of lost time, confusion and hazard. Inaccurate estimates of one pilot at such times may not only cause needless milling around of all other planes in the vicinity, but also hold on the ground planes ready to take off.

From the point of time conservation, an accurate estimate of arrival is important to the pilot himself, particularly in making an approach to any field. This is because he must be able to plan an efficient descent to the field from his cruising altitude. He will be flying at a specified altitude because he finds it favorable, and a premature descent to the approach altitude will entail a definite loss. On the other hand if he arrives over the field too high, he is again definitely losing time.

For example: A pilot cruising at 8000 ft. and making 180 m.p.h. is approaching a 1000-ft. airport; the surrounding country allows an initial approach at 2000 ft. Thus he has 6000 ft. to descend in the most efficient way. Under average conditions with a Douglas DC-2, this would be 300 ft./min.; therefore, at that rate, the descent would be begun 20 minutes prior to the estimated arrival time. If the pilot arrives 10 minutes before his estimate, he will be 10 times 300, or 3000 ft. higher than necessary, and since he is limited to a maximum of 500 ft./min. descent for passenger comfort, he must necessarily waste 6 minutes losing this altitude. If he arrives 10 minutes later than estimated, he will be 30 miles from the field at his initial approach altitude,

"Since much flying is accomplished without sight of ground, accurate navigation must be possible . . . "

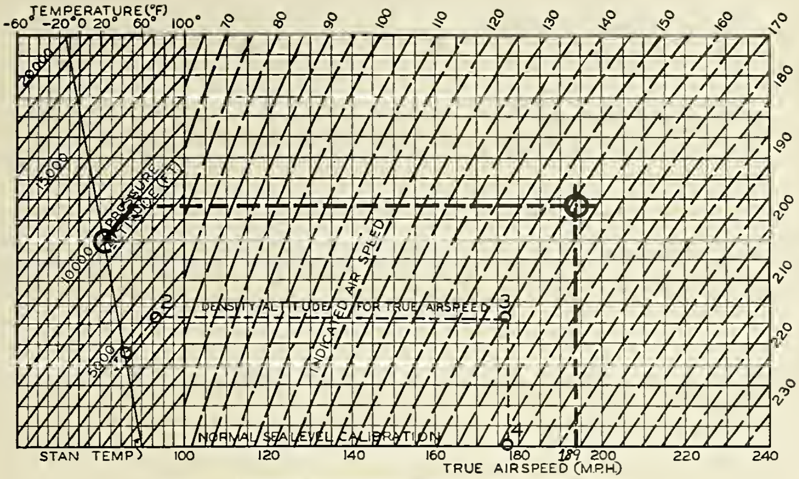


Fig. 2. Airspeed conversion chart for the Douglas DC-2

and will fly in from there at a decreased rate of speed. He could have been cruising at a higher rate of speed at the higher altitude, and made the 30 miles in less time and greater comfort. On instruments in turbulent air, he would probably proceed in low pitch, and gear down at 120 m.p.h. which would represent 15 minutes instead of 10 minutes under cruising conditions. In addition to preventing a definite loss of time, an accurate arrival permits precise planning of the approach and its smooth execution under any flyable weather condition.

TWA, Inc., has developed a standardized form, termed the Flight Log, which after several modifications is now considered well-adapted to the needs of present-day operations. The influence of nautical navigation apparent in it is perhaps explained by the fact that Navigation Engineer Peter Redpath, its originator, served as navigator in the Merchant Marine.

The Fight Log is shown in figure 1 and has been filled out by the pilot of Flight 6 from Kansas City to Columbus. The log, in blank, could be filled in for any type of special flight not covered by one of the numerous forms kept available to cover all of the scheduled flights of the system.

Kept by the pilot during the trip, the log contains all navigational data normally written down. For eastbound flights (as in this example) the form is filled in from the top downward, while for westbound flights, the reverse is true. Being divided horizontally into sections (one for each leg of the flight) the log is equally suited for long flights or those making intermediate stops. It is also divided into groups of columns, as indicated by the heavy vertical lines, each for a phase of the work.

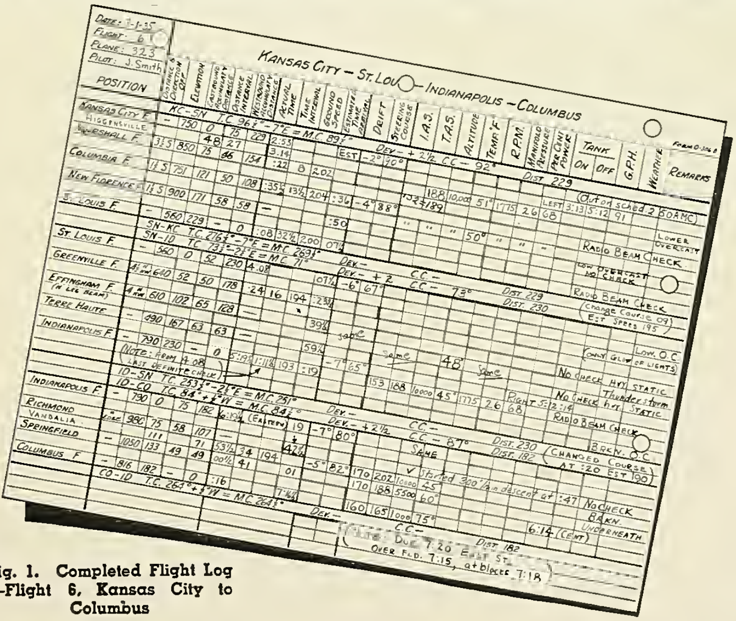
In the first column are the major check points, usually the terminal and emergency field. All radio check points are included, and are sufficient for accurate work when ground contact is not maintained. The next five vertical columns give the position from the check points to the straight line course, the elevations and the distances. The blank lines are provided so that the pilot can substitute other check points or add more during the trip. The next group of four blank columns are for time and speed figures. The two center columns are for drift and course, and are supplemented by horizontal lines of figures between sections giving the true course, the average variation, and the equivalent magnetic course, with blank spaces for deviation and resulting compass course. For eastbound flights this data is directly above the appropriate section; for westbound flights it is in the line directly below that section.

Flight 6 will be used as an example, as the flight plan for this trip was worked out in the November issue of Aero Digest. The first important entry is the actual time on-course, leaving the Kansas City field, which is 2:53 a.m. This is not the official departure time, that being noted at the right end of that line as "out on schedule at 2:50 a.m. Central."

The next important time to be registered is when the pilot levels off in cruising flight, and when visibility permits, that position is noted on the first blank line. In this case Higginsville—48 miles out, at 3:14. If the pilot was flying on instruments before this point he could closely estimate the position from the actual time on-course and the average climbing speed.

The deviation is taken from the compass correction card, plus 2½° giving the compass course of 92°. Applying the estimated drift correction of —2° taken from the flight plan determines the preliminary steering course of 90°. This course is held until checks, either visual or by radio beam, indicate what further corrections should be made.

As soon as cruising conditions have stablized, the required cruising information is filled in. The I.A.S. (indicated airspeed) is read directly from that instrument; T.A.S. is the true airspeed. The next four columns are filled in with the information on altitude, temperature, engine r.p.m. and manifold pressure. The percent power, 68%, derived from the cruising chart (see preceding article) is entered in its appropriate column. The true airspeed is read directly from the bottom of this same chart and is entered as 188. The I.A.S. corrected for altitude and temperature also gives the T.A.S., which is shown directly below as 189. When care has been taken to stabilize conditions by holding the plane level for a sufficient length of time, the two airspeeds thus obtained serve as a check on


Date: 7-1-35
Flight: 6
Plane: 323
Pilot: J. Smith

KANSAS CITY – ST. LOU – INDIANAPOLIS – COLUMBUS

Form O-16

POSITION | Distance & Direction Off | Elevation | Eastbound Accumulative Distance | Distance Interval | Westbound Accumulative Distance | Actual Time | Time Interval | Ground Speed | Estimated Time Arrival | Drift | Steering Course | I.A.S. | T.A.S. | Altitude | Temp. °F | R.P.M. | Manifold Pressure | Per Cent Power | Tank On | Tank Off | G.P.H. | Weather | Remarks

Kansas City F.
Higginsville
Marshall F.
Columbia F.
New Florence
St. Louis F.
St. Louis F.
Greenville F.
Effingham F. (N. Leg Beam)
Terre Haute
Indianapolis F.
Indianapolis F.
Richmond
Vandalia
Springfield
Columbus F.

Fig. 1. Completed Flight Log —Flight 6, Kansas City to Columbus

the accuracy of data in this group.

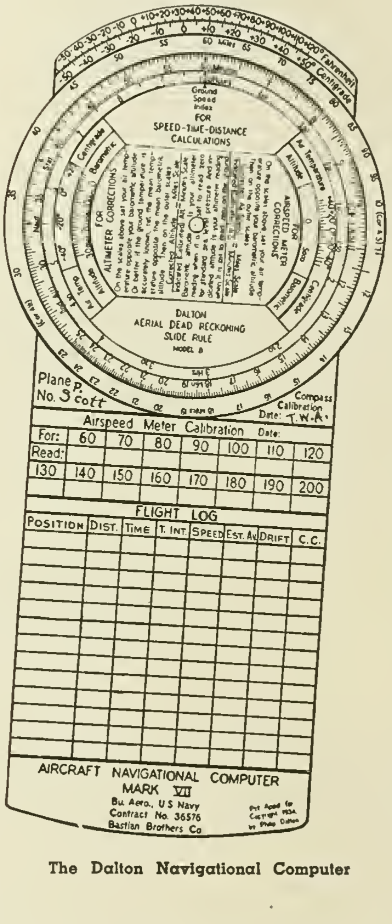
In the interest of more accurate conversions of indicated airspeed to true airspeed, a chart has been prepared for the Douglas DC-2. This is shown in figure 2. (The use of this chart is described in detail in the September issue of AERO DIGEST.) The heavy dotted lines indicate the steps taken in making this conversion. This chart takes into account the airspeed meter calibration for the DC-2 in addition to altitude and temperature corrections and is therefore not directly applicable to other planes. It is only when there is a change in cruising conditions that it again becomes necessary to make these entries.

The time of switching on the left main tank, is noted, as "left 3:13". When this tank is turned off, the time is shown in the "Off" column. From the amount used, the fuel consumption is entered in gallons per hour, in the G.P.H. column. In this example, a full tank of 180 gallons was drained by 5:12 a.m. or in 1 hour 59 minutes, giving a fuel consumption of 91 gallons per hour.

The time over Marshall field was accurately noted as :22, and the 27 miles from Higginsville were covered in 8 minutes, giving a ground speed of 202 m.p.h. For a distance as short as this, a quarter of a minute error in time would give an error of from 7 to 8 m.p.h. in speed. However, as consecutive time checks are made covering greater distances, this speed is more accurately determined. Care must be taken to get an accurate time check and accurate distances, and where both members of the crew are cooperating in this it is essential that they agree on their position with respect to the mark, and that their watches coincide, or that they both read the ship's clock from the same angle. An error of one minute in time or three miles in distance, would result in an error of 10% over a thirty-miles distance at 180 m.p.h.

When consecutive time checks give the pilot a definite ground speed, the accuracy of the Flight Plan is evident, and if it is found advisable, the cruising power will be changed. Once the speed is well-established by a number of time checks, the estimated intermediate arrival times can be filled in for the entire flight. By keeping this running check, a pilot can tell his approximate position by looking at his watch, and the ground glimpsed through broken clouds, or the glow of a city, can be readily identified.

Referring to the drift and steering course column, the pilot allowed for the drift indicated on the Flight Plan. At Columbia he found he was drifting off his course to the right, and so he made an additional 2° correction. By holding as straight a course as possible, and making positive corrections for drift at infrequent intervals, a definite idea of drift is obtained. If the pilot continually varied his course, correcting for drift in an endeavor to exactly follow the course, the frequent changes would be confusing. In this case, taking the average drift of 3° to the right, a 13 m.p.h. gain from the wind, the difference between the average ground speed and the true airspeed, the wind is found to be 17 m.p.h. from 303°. This agrees fairly well with the estimate on the Flight Plan, so in changing his course at St. Louis, the pilot allowed 6° for drift to the right on his new heading (5½° was shown in the Flight Plan). These calculations serve as a check against the forecasted winds aloft, and a check on the ship's instruments, particularly the compass.



The Dalton Navigational Computer

For making the aforementioned calculations some form of aerial calculator or slide rule is used. The Dalton Aircraft Navigational Computer, Mark VII, is a favorite. One side of this instrument is used as a slide rule for time, speed and distance calculations. The other side, is used for solving wind triangle problems, and is particularly suitable because the solution is worked out graphically and can be readily checked by inspection. For private pilots a simplified flight log printed on the celluloid face of this computer is convenient. Figures in pencil can be readily erased after the flight.

Unfavorable weather has been chosen for this example, because if a method is to work it must be adaptable to the least desirable of conditions. With some idea of speed and drift, the pilot can by dead reckoning fly relatively close to each check point, and because he knows with a fair degree of accuracy when he will pass over it, he can often pick up landmarks or radio beam signals. A man bewildered as to his position and progress might miss them completely. In this example no check is obtained for a distance of 178 miles, yet, having accurate data on the preceding leg of the flight, the pilot calmly proceeds on his way with a knowledge of his position which is more accurate than others would have on a clear and unlimited day. While a pilot would not intentionally make an approach in a hazardous area on the basis of his navigation alone, in the rare event of a radio failure, he does have definite information upon which to base his plans. A scheduled flight, proceeding on top, or on instruments, is required to have an alternate field, at which the ceiling is not less than 1500 ft., and the visibility two miles or more so that the pilot could, if necessary, fly a dead-reckoned course and land there without hazard. The possibility of an error in his paper calculations can be guarded against by a careful check by the other pilot in the crew. This cooperation and checking in navigation between crew members is facilitated by having every pilot with the company use the same standardized form.

In passing over the Indianapolis beacon station about as estimated, and knowing definitely his power and fuel consumption, the pilot is not hesitant in continuing over that field for his final destination, knowing that he will have ample fuel, and if necessary, could proceed beyond Columbus to any one of several alternate fields. After getting a check over Indianapolis, the time and distance from St. Louis was used in determining the airspeed, because that was considered the last accurate check. In general, a check over considerable distance is desirable except where a shift in wind is anticipated, but there is no rule on this.

As noted on the sheet, a descent of 300 ft./min. was started at 6:47 a.m.e. so that the pilot would be 500 ft. above the ground at the time of estimated arrival. The ground elevation, 816 ft. plus 500 ft. subtracted from the 10,000 ft. cruising altitude, and divided by 300, shows that 29

(*Continued on page 72*)

EDITORIALS

"During the past fiscal year, ending July 1, 1935, the aircraft operating with the Fleet flew approximately 15,000,000 miles without a single plane being lost through navigational errors. In so far as perfection of material and skill of operation are concerned, I can assure you that American Naval Aviation is equal to that of any aviation organization."—CAPTAIN FRANK R. McCRARY, U.S.N., Assistant Chief of the Bureau of Aeronautics, Navy Department.

Report on the Boeing 299

● Crashes and their publicity are distasteful because they leave evidences of imperfection. The Boeing Bomber accident was no different except that an Army Air Corps investigating board, in establishing the facts in the case, found that neither structural nor functional failure caused the regrettable loss.

Perhaps the Boeing Company finds solace in the thought that its engineers, designers and craftsmen assembled a plane which was lost through no fault of theirs. But such solace is little compensation for the destruction of a plane which gave great promise of changing the conception of modern aerial warfare. The fact that personnel failure may have been the paramount cause does not lessen greatly the blow to that organization.

Findings of the Board of Officers convened to investigate the cause of the crash, were to the effect that the accident was not due to structural failure, or to the malfunctioning or failure of any of the four engines, the airplane control surfaces or the automatic pilot, but to the locked condition of the rudder and elevator surface controls (primarily the latter) which made it impossible for the pilot to control the airplane.

These findings were based on the locked condition of the controls after the crash; the testimony of Lieut. Donald Putt, co-pilot; of Leslie R. Tower, Boeing test pilot, as to the behavior of the airplane in the air, and the testimony of eye witnesses as to the behavior of the airplane on take-off and in flight.

From the evidence submitted, the Board reached the conclusion that the elevator was locked in the first hole of the quadrant on the "up elevator" side when the airplane took off, for had the elevator been in either of the "down elevator" holes on the quadrant or the extreme "up elevator" hole, it would have been impossible for the airplane to be taken off in the former case, and in the latter case the pilot could not have gotten into the seat without first releasing the controls. With the elevator in this position they are inclined at an angle of 12½°.

During the take-off run the airplane could not assume an angle of attack greater than the landing angle of the airplane (7½°) plus the angle of incidence of the wing to the fuselage (3°) or a total angle of 10½°. This would not be particularly noticeable to the pilot during the ground run.

However, as soon as the airplane left the ground, which several witnesses testified was in a tail low attitude, the elevators, with increasing power, varying as the square of the airspeed (approximately 74 m. p. h. at take-off), tended constantly to increase the angle of attack, until the stall was reached. The servo tab on the elevator also tended to aggravate this extreme tail-heavy position, since with locked elevators, and the pilot pushing forward on the control column, the servo tabs were up, and themselves acted as small elevators on the fixed elevator.

Due to the size of the airplane and the inherent design of the control system, it is improbable that a pilot, taking off under these conditions, would discover that the controls were locked until too late to prevent a crash.

The locked condition of the controls was due either to the possibility that no effort was made to unlock the controls prior to take-off, and as a result the controls were fully locked; the possibility that the pilot only partially depressed the locking handle and as a result the locking pin was only partially withdrawn from its hole in the face of the locking quadrant; or the possibility that the locking handle was fully depressed prior to take-off and did not fully disengage the locking pin.

Obsolete Equipment Of Our Air Force

● Between 250 and 300 first-line aircraft and probably 3000 officers and men are to be added to the program expanding the British air force, bringing the total number of machines to 2190 at the end of two years. This represents only one-fourth of Britain's aerial strength, as for every machine in service the air force will have three in reserve.

Compare this to conditions in the GHQ Air Force of the U. S. Army Air Corps. Cy Caldwell's article in this issue points out that we have only about 165 modern fighting planes. Great Britain is definitely resolved not to weaken her aerial force for home defense. We seem as definitely determined that our aerial force shall linger in the doldrums because of ineffective control and obsolete equipment, ships that are four to eight years old (and getting older every day), lack of funds and prejudicial control of the General Staff.

Other nations have put air power in a department where it cannot be controlled by the army or the navy. These countries are really giving their people the protection they are entitled to and have every right to expect. It is time the United States realized its military aeronautical deficiencies and promptly did something constructive to remedy a condition which keeps us far below the "second to none" standard set by the 1925 Morrow Board.

Airport Lessons From Abroad

● When Albert Plesman, managing director of K.L.M. visited the U. S. recently, he took most of our American airports over the jumps, saying that while our fields adequately serve the immediate purpose for which they are intended, they are not inviting to the general public. In Europe, airports serve a dual purpose. They are not only landing fields for aircraft, but are also public entertainment centers. For "three nickels" one gains admittance to the field; for three more nickels, a guide takes him into the hangars, operations offices and control towers, and to the uninitiate, describes the workings of the airport. Meals are served on spacious verandas where, to the accompaniment of music the public may enjoy good food and drink, while watching activities on the field. More than being a source of additional revenue to the airport, this plan encourages air-mindedness and fosters quicker development of the local aircraft industry.

Of course there are a few bases in this country that are outstanding along these lines. For example, there is the Miami seaplane terminal of Pan American Airways. This base is made so attractive that it has become a point of interest not only to the air travelers, but also to the general public and tourists who include it in their itinerary. Visitors find a substantial passenger station amid pleasant surroundings, featuring a first-class (and moderately-priced) restaurant and bar, and always enough activity within sight to hold their interest. Competent and intelligent guides explain the workings of the base and conduct groups of visitors through the hangars and planes.

The United States may lead the world in air transportation, but there are a few things we still can learn from our European contemporaries.

Personalities

By Caldwell

● LT. COLONEL W. D. Tipton is a double-barrelled fighting man from away back—away back in Jarrettsville, Maryland, where he was born Dec. 11, 1892. He runs in two sections as a Lt. Colonel in the Air Corps Reserve and as another Lt. Colonel in the Air Corps of the Maryland National Guard, serving as Air Officer on the staff of the 29th Division. It's nothing at all for him to sit down as a Lt. Col. in the Air Corps Reserve and write himself a stiff letter as a National Guard officer; and if he gets sufficiently annoyed as a National Guard officer he can write back to himself as an Air Corps Reserve officer and tell himself to go chase himself all around the fair state of Maryland. At first he experienced some difficulty when trying to think at one time as an Air Corps Reserve officer and at another time as a National Guard officer; but when he got on the Staff he solved the problem by not thinking at all. If he had done that a few years ago he wouldn't have lost all his hair.

Colonel Tipton was educated at Western Maryland College, where he took the academic course and received an A.B. degree—Able Bodied. Then he took a whirl at Johns Hopkins University, Engineering Course, and won a B.S. degree—which isn't what you think it is. But even this wasn't enough learning for him. He enlisted in the U. S. Air Service in May, 1917, attended the School of Military Aeronautics at Ohio State University, Columbus, and then had himself polished off in the School of Military Aeronautics, Royal Air Force, at Oxford University, Oxford, Herts, Nerts, England. He was now stuffed to the neck with expensive education and ready to shoot down Germans, using a Vickers gun and an Oxford accent, either of which alone is enough to floor anyone; so it is not surprising that he is officially credited with the destruction of four enemy airplanes and one observation balloon. He was mentioned seven times in Royal Air Force communiques, was awarded the Distinguished Flying Cross of Great Britain, which was presented by the Prince of Wales, and is entitled to wear three major campaign stars on the Victory Ribbon. In view of all this I recommend that the Governor of Kentucky make him a full Colonel, like Roscoe Turner.

Trained by the Royal Air Force, he was put on active service with No. 3 Squadron, R.A.F. as a flying officer, and later was made Flight Commander in the 17th Squadron, U. S. Air Service. "The high point in my war career," he writes in answer to my inquiry," was my first angry patrol, a wireless interception job with a British pilot who didn't know much more than I did. The British had a trick of locating working German two-seaters by using two direction-finding radio stations and getting two lines on them, and intersecting these lines to get a fix. On this day we found the two-seater Okay and proceeded to sneak up on him. At about 1,000 feet range I tried to steady my bucking Camel and fix the Rumpler in my Aldis sight, allowing deflection in the approved ground school manner. Then I squeezed the gun control and watched my tracers sail all around the sky. The Rumpler, in a very bored manner, did a climbing turn to the left, apparently so that the pilot could see the rest of the show. The curtain went up for the second act, and down came five Pfalz on my tail. I finally did get home looking like a piece of Swiss cheese and feeling like a piece of Limburger. All of which was very fitting, for I had tried to steal the bait from Heinie's trap and damn near got caught in the process." What happened to the accompanying British pilot deponent sayeth not. But on Aug. 26, 1918, the Germans taught Bill Tipton not to get too fresh with them by shooting him down, taking him prisoner, and keeping him in a German prison camp until Jan. 4, 1919. He was out on a ground strafing expedition one windy afternoon when he and his flight were hopped on by about 25 Heinies. Bill was driven down with his instrument panel full of explosive bullets and in a hot spot. Finally a German machine gunner on the ground put him out of his misery by shooting off his gas line and popping a little hot lead in his legs. His last wartime landing was a good one; he was able to walk away from the wreck.

Bill Tipton, the bun thrower

Upon his discharge from the service he was commissioned as Captain, Air Corps Reserve, and Captain, Air Corps, M.N.G., later being promoted to Major, in command 29th Division Aviation, M.N.G., which unit he commanded for five years. He has been a double-jointed Lt. Colonel for the past four years. He formed his own commercial aviation operation in 1919, doing aerial photography, and in 1925 organized the Chesapeake Aircraft Co. in partnership with the late John A. Hambleton, one of the organizers of Pan-American Airways. It was in 1926, when Bill was a Major and in full enjoyment of that expensive education I've mentioned, that I sneaked up on him with a Travel Air demonstrator on which I had already piled up some 200 hours. With all of the low animal cunning common to an airplane salesman, I unloaded that demonstrator on him at full list price, and made him feel that I was doing him a favor by letting him have it—and I only got as far as the 8th grade, myself, and have had some difficulty in making the grade ever since, because unfortunately I didn't find many as easy as Bill.

However, that Travel Air, toil-worn though it was, made Bill Tipton a vice-president. Finding himself in possession of such a fine craft, he formed a company and elected himself vice-president—the President was the innocent who had put up the money. Incidentally, Walter

Beech may be interested to know that this old OX 5 Travel Air remained in service until 1932, paying for itself several times over. Tipton served as pilot and flying representative for the Baltimore *Evening Sun,* the first newspaper in the U. S. to own and operate its own airplane, back in 1919. He also served as special feature writer on aviation for the *Sun,* conducting a regular column for a period of 13 years. Since February of this year, in collaboration with Jesse Harrison Mason, a Baltimore artist, he has been writing a newspaper feature called "Flight", distributed by McNaught syndicate, appearing in over 60 papers throughout the U. S. It's very good, too—I'd rather that it wasn't, for then I could have some fun with it.

Of course, even in his commercial activities, Lt. Colonel Tipton runs in two sections. In July, 1933, he leased the Curtiss-Wright Airport at Baltimore and is now operating it and the Baltimore Flying Service, Inc. Before that time he had managed the base for Curtiss-Wright, flown in the winter of 1928-'29 as a pilot for Pan-American Airways from Miami to Havana and from Santiago, Cuba, to San Juan, Puerto Rico. A man of many activities and many moods, his favorite sport is hurling buns about at banquets.

* * *

• NOBODY IN aviation enjoys his job more than Jim Erdman, the demon salesman of Taylor Cubs. Never a hound for work myself, I marvel at the enthusiasm of a man who often starts flying at five or six o'clock in the morning, travels as much as 800 miles a day in a Cub and then carries on interviews until long after midnight. In ten days, for instance, he visited 49 airports in seven states. He indulges in whirlwind interviews, whirlwind demonstrations, and then is off in a cloud of dust.

This selling of Taylor Cubs has become practically a mania with him. The last time I met him at Roosevelt Field he paused long enough to tell me that from January 1, 1935, until that day, September 25, the Taylor Aircraft Co. had registered with the Bureau of Air Commerce 74 Cubs, sold and delivered in his territory. Some were sold by dealers whom Jim had appointed, but he had personally demonstrated the Cub to 97% of the people who signed on the dotted line. He has the stamina of a vacuum cleaner salesman, the persistence of an insurance agent, and the tact of a foreign diplomat fooling the American State Department. Jim's territory comprises the Atlantic seaboard states; he has flown and demonstrated Cubs from Montreal to Miami and has criss-crossed the states from East to West *en route.* His output of energy is simply staggering to one of my quiet and listless temperament.

That day when he abruptly leaped into a Cub at Roosevelt Field and left me staring after him, he remarked that the Taylor company had at that time delivered 159 Cubs since January, and expected to sell 250 by the end of the year. As for his own territory, he said, if it fails to absorb 100 Cubs by December 31 he will break down and cry bitterly, feeling that he must have been loafing somewhere along the line! He says that his sole ambition right now is to sell more airplanes, personally and through dealers and distributors whom he has appointed, than any other factory representative in the United States. I wouldn't be surprised if he achieved that ambition, unless he burns out a bearing in his dizzy rush to success.

You know, I can't understand such demon demonstrators, such hounds for punishment. In a dazed and feeble effort to understand the dynamic Jim Erdman I held him down long enough to get a brief account of his life. I still don't know what makes him tick over at such a speed. For one thing, though, he was out of work for fourteen months before getting his present job; and it is just possible that in that period he stored up such a tremendous charge of energy that he can't get rid of it even by working sixteen hours a day. If such is the case, just ponder the amount of latent energy seething in the breasts of the farmers and the 10,000,000 unemployed, and what it will do when it is released in jobs if the Republicans get back in and permit business to stagger to its feet! Just think what will be accomplished when President Roosevelt and his brainstormers are forced by the voters to stop paying farmers large salaries for not raising wheat and cotton and hogs and potatoes! And think of the energy, in foot pounds, that will be generated once we tell the W.P.A. and P.W.A. Boondogglers to stop leaning on their shovels and actually move some earth with them!

Smiling Jim Erdman

Well, let's leave Mr. Roosevelt, and get back to the more worthy subject of Mr. Erdman, who actually believes in working in these days sacred to the bums, whose votes are being purchased by Mr. Roosevelt with our money. Jim Erdman was born in Atlanta, Georgia, not an especially energetic spot, on Sept. 22, 1893, and spent the first fifteen years of his life in that city during the period when its somnolent Southern charm was just beginning to be affected by the rush of industry from the North. Then his family moved to South Carolina for a year, after which they returned to their original home in Baltimore, Md., where they resided before Jim was born. Here, at the age of seventeen, he left school and entered the printing business as a printer's devil, emerging at the end of eight years as assistant to the efficiency expert of the company. This was in 1917, the year in which the United States decided to finance a European squabble in which they had nothing stronger than a financial interest, being sucked in because they wanted to protect their original ante. Of course, as we have learned since, our political leaders were mere amateurs in the international poker game, and paid cash into the kitty while the foreigners chucked in a few I.O.U.'s which so far they have failed to retrieve, and probably never will.

Young Jim, however, understanding nothing of this (as who did at the time) leaped into the fray as a cadet in the Air Service, and spent the next year unloading and setting up Standards with Hall-Scott engines, building roads about various camps, and occasionally aviating in the crude craft of those days. A cadet's lot, like that of a policeman, was not a happy one, though being young and full of vinegar Jim stood it as well as most of them. He even survived a spin from 1,100 feet in a Jenny piloted by a Lieut. who had had thirty hours of solo, and only about one spin before that one. The Lieut. was killed, but the cadet, being tougher, survived, although he spent two months in the hospital thinking over man's delayed conquest of the air. He had, he told me, recalled some words of wisdom by Lieut. Ken Fraser, who had said that if worst came to worst, the embryonic aviator should brace himself for the inevitable by placing his feet on the dashboard and shield his head and face with his arms. This Jim had done, receiving a broken arm and nose, but clinging to life in a dogged way and achieving his commission soon after his discharge from the hospital.

He had at that time 186 hours, so was made an instructor at Taylor Field for two months, then was sent to Post Field, Fort Sill, Oklahoma, to give advanced instruction until Feb. 22, 1919, when he received his discharge. He started selling oil stock, and was too smart to buy any himself, as most oil stock sales-

(*Continued on page 72*)

The Americas and the Orient Linked by Air

●

● Pan American Airway's initial thrust into the 9000-mile airway linking the United States with the Orient comes at a time when the world looks with admiration at our air transport accomplishments, not across oceans, but within the confines of our own boundaries. For from January 1, 1935, to the moment the silvery hull of the Martin *China Clipper* disappeared over the Golden Gate and into the west on November 22, close to 700,000 persons had taken a trip over our domestic airlines, bringing aerial travel to a peak never before attained.

The popularity of our airlines grows daily, and each year brings greater advancements in traffic. To charge this influx only to dependability, safety and reliability would be to slight the foresight and pioneering spirit of all those airline executives who not only make us the world's greatest aerial nation, but who also contributed no small part in the realization of trans-Pacific service.

Among these men are Juan T. Trippe, president of Pan American Airways, Andre Priester, his chief engineer, and Col. Charles A. Lindbergh, their technical advisor. Four years before overnight service to Honolulu became a reality, they met to discuss, conjecture and plan ways to attain closer relations between industrial America and the rich markets of the Far East. Slowly their ideas took definite form.

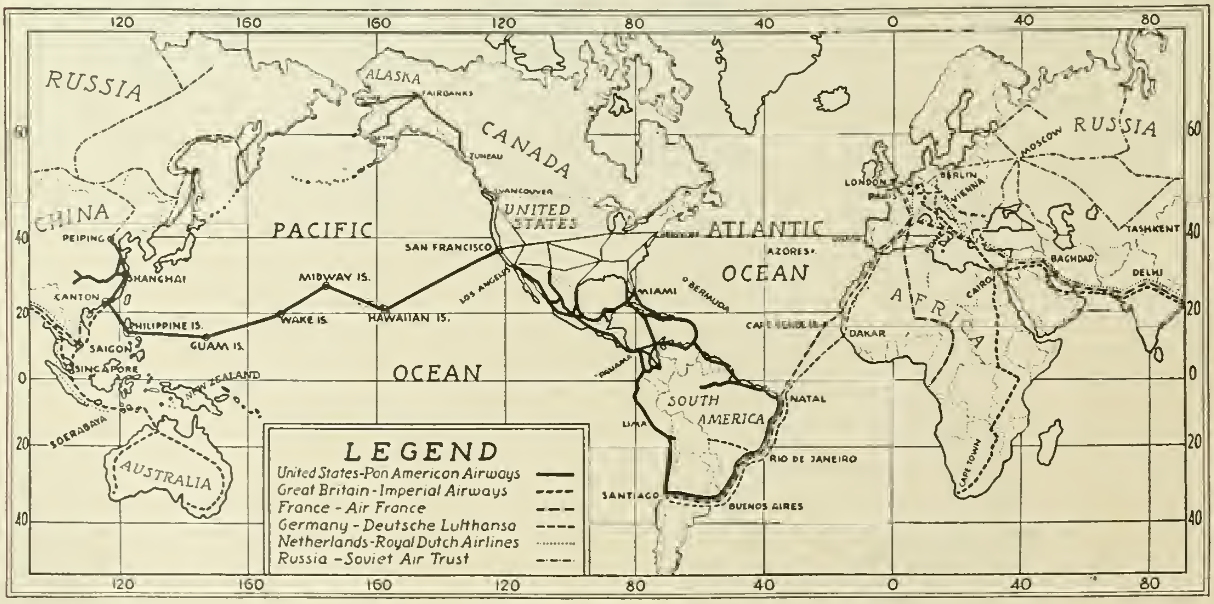
Juan Trippe, President of Pan American Airways, Inc.

First they laid out the route, picked logical landing stations, and finally agreed on Hawaii, Midway, Wake and Guam as stepping stones across the ocean. All are possessions of the United States so no international problem arose to complicate Part One of the plan. Usually, an attempt to extend a route over another nation's territory must always be attended with endless negotiations, delays, often divided authority over operations, sometimes even a division of traffic and alteration of schedules with an airline of the nation through which the line will run.

The question of a suitable vehicle with which to fly a wide expanse of ocean—2410 miles from the mainland to Hawaii and longest open-water stretch on any ocean trade route—presented a more difficult problem. At the time there was no equipment built or building which could fly that distance with a safe reserve, let alone a commercial load. But Igor Sikorsky and Glenn L. Martin looked at specifications laid down by Pan American and agreed it could be done—in time. Part Two was at least a possibility.

Careful navigation and accurate calculations were necessary for safe and reliable service. Midway and Guam are just spots on the ocean; Wake, an uninhabited coral atoll, is a thousand miles from its

(Continued on following page)



Pan American Airways' routes and their connections with various foreign airlines

Built for a prominent manufacturer of transport airplanes, this largest and latest AIRWHEEL with Goodyear multiple disc hydraulic brakes, is posed beside our smallest tail wheel tire

Now comes a still bigger AIRWHEEL*

AS MASTERY of the skyways progresses with larger ships, Goodyear keeps pace by providing equipment essential to comfortable landings and take-offs.

Thus the largest Airwheel yet needed was requested by one of America's largest makers of airliners. And to give pilots dependable ground control, Goodyear multiple disc hydraulic brakes were specified also.

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Completely, competently, Goodyear serves the tire, wheel and brake needs of aviation. Try Goodyear *first*—just write Aeronautics Department, Akron, O., or Los Angeles, Cal.

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★IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL! AIRWHEEL is Goodyear's trademark, registered in the U. S. A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of AIRWHEEL tires.

WHEN YOU BUY A NEW SHIP SPECIFY THE GOODYEAR AIRWHEEL AND THE NEW GOODYEAR HYDRAULIC AIRWHEEL BRAKES

(*Continued from preceding page*)

nearest neighbor. The solution to Part Three was found in the years during which the first huge ocean flying boat was being built. Radio, developing rapidly, was fast becoming an invaluable aid in aerial navigation. Technicians were developing and perfecting the radio beam and radio compass. The gyropilot, too, was coming into its own along with numerous other devices to help the accuracy and practical comfort of high-speed aircraft transportation.

At last all paper plans were complete. The great question now was, "Will all these work out in actual service and jigsaw together to give a complete and dependable ocean service?" Hopes were not tempered by the fact that these pioneers knew at the outset that if they could not devise means of building an American airline to Asia, America's bid for a share of the many billion dollar trade of the Orient would soon face a hopeless obstacle. Even then four long airlines were reaching out from Europe transversing country after country, all pointing toward the Far East. Soon European trade would be flowing to Eastern Asia in half the three weeks interval it takes to travel from our West Coast to China by steamship.

Capt. Edwin Musick and the crew that made the first experimental flight across the Pacific in the Sikorsky S-42

Priester answered for the men and organization for this service early in those preliminary discussions. He and Lindbergh set up a new and exhaustive training program working out an ideal conception of a crew to man a transoceanic flying boat. There was to be a captain, co-pilot, navigator, radio officer, and flight engineer. Each was to be able to perform the duties of another in case of an emergency; each underwent a specialized training in every phase of air transportation. A 1250-mile stretch over the Caribbean from Miami southwest to Barranquilla provided an ocean laboratory to train crews in out-of-sight-of-land navigation. The appointment of Col. Clarence M. Young, former Assistant Secretary of Commerce for Aviation, as manager of the newly-created Pacific Division, assured level-headed and enterprising control of all other major problems.

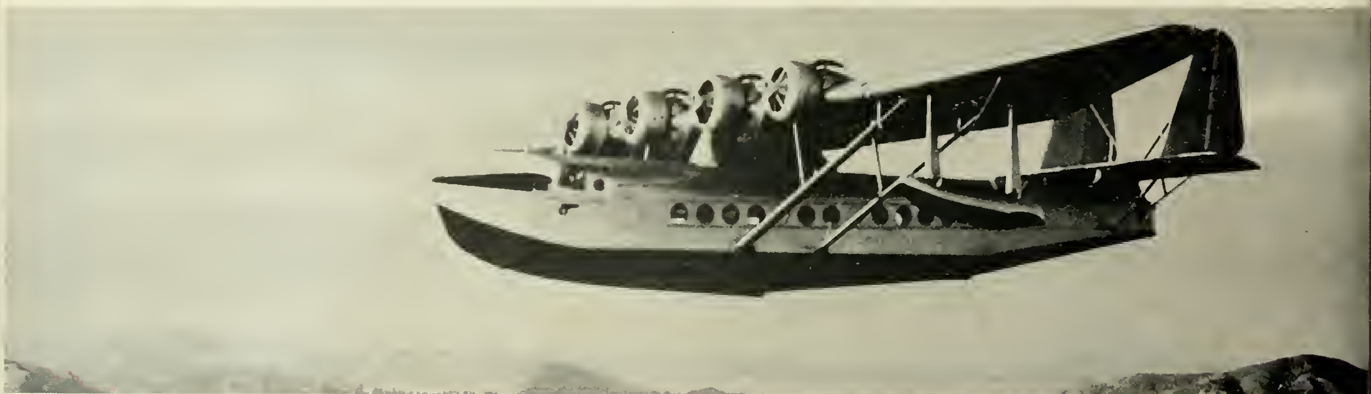
Early in 1934 the first of the Sikorsky S-42 Clipper boats was ready. Here was a plane that was laid down to meet established requirements for a high performance, highly efficient marine transport aircraft capable of maintaining scheduled transport service with adequate mail loads, over a non-stop range of 2500 miles with an airspeed of 145 miles an hour against a 30-mile headwind. During the two years the craft was under construction and development, the need for carrying passengers in addition to mail, resulted in additional stress being placed upon the craft's ability to fulfill this new requirement, adding, as it did, new complications to the basic problem of design.

Any doubt as to its ability was soon dispelled. On May 17 it climbed to a world record of more than 20,400 feet carrying 11,023-pounds of load; on August 1 it established speed and load records in eight official categories. Soon it was placed in service over the ocean laboratory and the picked crews were becoming more intimate with the type of flying they would experience over the Pacific. They took noon sights of the sun to figure their position, they checked them with radio bearings from shore stations, they practiced navigation by dead reckoning using drift sights on the ocean surface.

Pan American then turned one of the three Sikorskys into a laboratory plane for the final phases of training for the Pacific project. Its cabin compartments were filled with fuel tanks; chart rooms were installed and special hatches provided for navigation. Preparations too were underway at Alameda base on San Francisco Bay, stepping off point for the westward flight.

Before the first flight could be undertaken, there was the gargantuan task of setting up completely equipped bases on each of the stops. Pan American

Sikorsky S-42, first to fly the Pacific Route



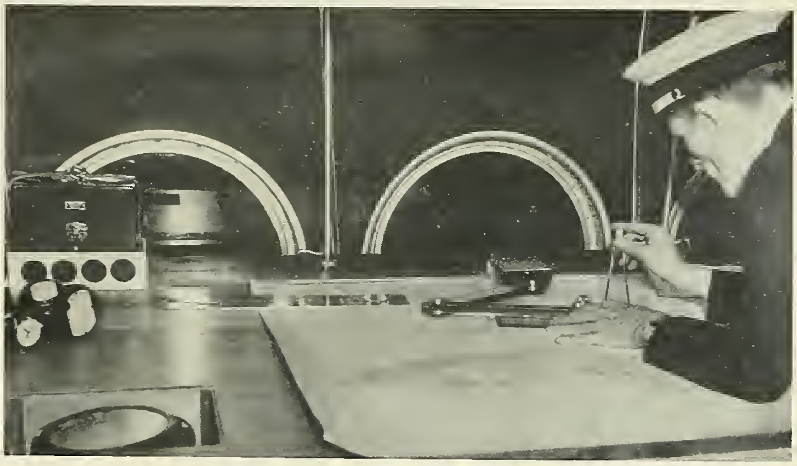
chartered the 15,000-ton steamer *North Haven,* loaded it with equipment necessary to establish a series of five ports, assembled a force of 150 workmen and technicians and set out to finish the construction of its ocean route. Three months were required for the job. Three hundred carloads of material safely transferred to the five ports of call; ground crews left at each port and the task of creating five complete, efficient air bases was well under way.

Docking floats, fuelling equipment, shops, offices, elaborate radio and living quarters at a cost of more than $2,000,000 were set up at Pearl Harbor in Hawaii, Midway Island, 1380 miles westward, Wake Island 1252 miles away, then Guam 1560 miles distant and Manila, 1580 miles further west, the last break in the journey before reaching China, 700 miles away.

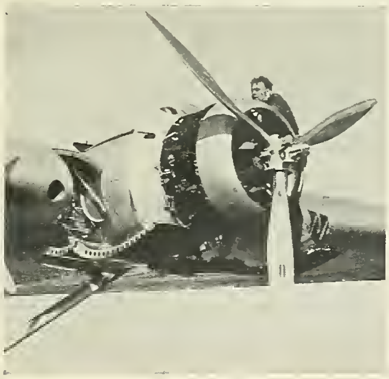
All was now in readiness for the initial experimental flight across the Pacific. The 19-ton four engined Sikorsky first went as far as Hawaii, set a new speed record and then returned. The second flight reached Midway before the ship was headed back. The third went to Wake and the fourth Guam.

Steadily, without an untoward incident to mar its 40,000 miles of Pacific test flights, the aerial pioneering went steadily forward in its exhaustive program. Nuclei for five crews had been trained aboard the experimental plane. Its trips confirmed a thousand calculations and estimates made by Pan American weather and radio technicians, maintenance specialists and filled in gaps in the types of data that can only be secured by direct tests. With completion of the Guam flight there were no more unknown quantities in the problem of flying an ocean airliner. The puzzle was solved and the pieces fit into a picture of complete and dependable service across 3000 miles of ocean from one continent to another.

Planes, bases, training were completed. So too was that most necessary adjunct—radio, and in this connection Pan American radio technicians have made remarkable progress in the development of light-weight, low-powered reliable installations which cover the entire Pacific from the air, and in the extension of aircraft radio direction-finding devices to unprecedented ranges.


Navigation desk aboard the Sikorsky

Each of the Clipper ships carries two sending sets, two receivers, and a dual antenna system. Even when on the water, with the engines off, batteries insure that all sets may be used for days to send position reports, get weather data, dispatch instructions to and from almost any spot in the Pacific. In the air the radio range is even greater; it was not unusual for the radio operator of the plane far beyond Wake to keep in constant touch with Pan American's base in Miami.


Tuning up one of the Pratt & Whitney engines before the flight, and, below, the Martin "China Clipper" making a landing

The regular type of radio beacons are not suited for trans-oceanic use. Pan American therefore standardized on the international routes a telegraph-signal type, then extended it in power. On each of its flights, the Clipper kept a constant running-fix of its position to the fraction of a mile by radio bearings it could take on ocean vessels and a half dozen shore stations, and it can check these readings with bearings taken by its base stations on its own signals.

Fog and obscured vision have also been overcome. A well-tried and proven procedure of using the radio direction-finders in conjunction with the flight instruments enables the ships to land smoothly and accurately in any of its base harbors in any weather. Sperry gyropilot installations also do their share of relieving the pilot from constant manipulation of con-

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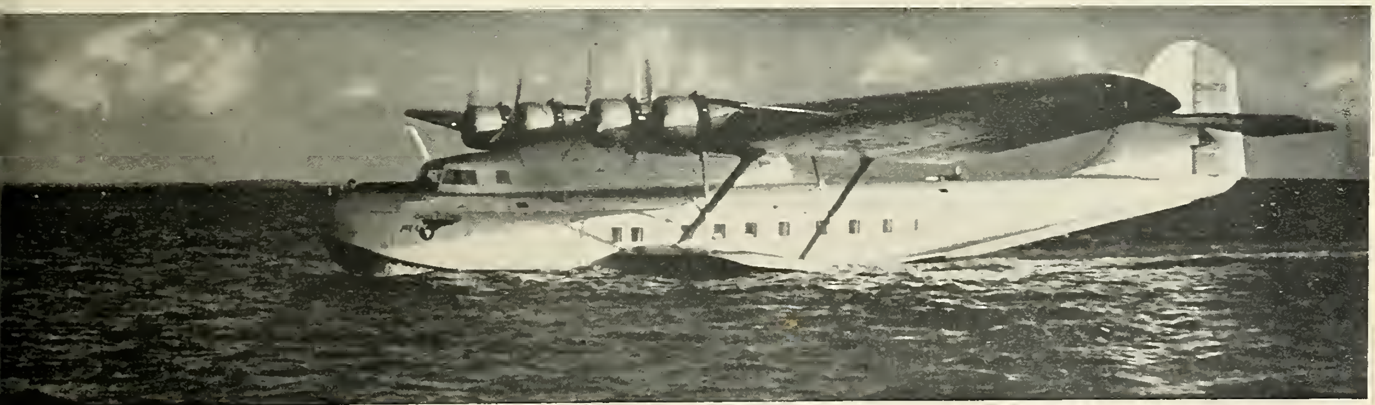

DR. ALEXANDER KLEMIN
GLENN D. ANGLE

AVIATION ENGINEERING

DR. MICHAEL WATTER
DR. MAX M. MUNK

PRECISE MOMENT EQUATIONS

●

A. WILLARD BURGESS

● In making the stress analysis of a rear wing spar with trailing edge flaps, the engineer may have difficulty in locating suitable formulae for the loading conditions obtained, due to the presence of a uniform load covering only part of the span.

The formulae presented here were developed using the general method and nomenclature given in *Airplane Structures,* by Niles and Newell.

The significance of the terms used in the various equations is as follows:

P = axial load
w = uniform lateral load
L = span length
x = distance from left support
M = moment
S = shear
y = deflection
i = slope of deflection curve
C = constant of integration

$$j = \sqrt{\frac{EI}{P}}$$

Equations for Single Span

The first step is to derive the formulae for a single span subjected to a uniformly distributed lateral load w_1 over the whole span, an additional uniform load w_{10} beginning at a distance a from the left end of the span and extending over a length b, an axial compression P, and restraining moments M_1 and M_2 applied at the points of support.

For a loading of this type, three cases must be considered in developing the equations: I—when x is less than a; II—when x is greater than a and less than b; III—when x is greater than b.

The moment equations can be written for these conditions and evaluated by following the method given in Art. 11:2, p. 188 of *Airplane Structures.* When this has been done there will be six constants of integration to be determined. Sufficient equations to solve for these constants can be obtained by equating deflection values and by equating slope values for Cases I and II at the left end of w_{10} ($x=a$), and by equating deflection values and slope values for Cases II and III at the right end of w_{10} ($x=b$).

The equations for moment, shear, deflection, and slope of the deflection curve for Cases I, II and III, and the values of the six constants, are given in Table I.

The derivation of the equations for Case I is given below to illustrate the method used. The formulae for the other two cases were developed in a similar manner.

Moment at any point

$$M = M_1 + \frac{(M_2-M_1)x}{L} - \frac{w_1Lx}{2} - \frac{w_{10}(b-a)\left[L-\frac{a+b}{2}\right]x}{L} + \frac{w_1x^2}{2} - Py \quad \ldots\ldots [1]$$

Making the usual assumptions of the beam theory,

$$M = EI\frac{d^2y}{dx^2} \quad \ldots\ldots [2]$$

From [1]

$$M + Py = M_1 + \frac{(M_2-M_1)x}{L} - \frac{w_1Lx}{2} - \frac{w_{10}(b-a)\left[L-\frac{a+b}{2}\right]x}{L} + w_1x^2/2 \quad \ldots\ldots [3]$$

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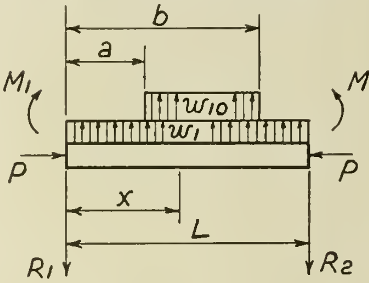

CASE I — when $x < a$

$$M = C_1\sin\frac{x}{j} + C_2\cos\frac{x}{j} + w_1j^2$$

$$S = \frac{C_1}{j}\cos\frac{x}{j} - \frac{C_2}{j}\sin\frac{x}{j}$$

$$y = \frac{1}{P}\left[M_1 + \frac{(M_2-M_1)x}{L} - \frac{w_1Lx}{2} - \frac{w_{10}(b-a)(2L-a-b)x}{2L} + \frac{w_1x^2}{2} - C_1\sin\frac{x}{j} - C_2\cos\frac{x}{j} - w_1j^2\right]$$

$$i = \frac{1}{P}\left[\frac{(M_2-M_1)}{L} - \frac{w_1L}{2} - \frac{w_{10}(b-a)(2L-a-b)}{2L} + w_1x - \frac{C_1}{j}\cos\frac{x}{j} + \frac{C_2}{j}\sin\frac{x}{j}\right]$$

CASE II — when $a < x < b$

$$M = C_3\sin\frac{x}{j} + C_4\cos\frac{x}{j} + (w_1+w_{10})j^2 \qquad S = \frac{C_3}{j}\cos\frac{x}{j} - \frac{C_4}{j}\sin\frac{x}{j}$$

$$y = \frac{1}{P}\left[M_1 + \frac{(M_2-M_1)x}{L} - \frac{w_1Lx}{2} - \frac{w_{10}(b-a)(2L-a-b)x}{2L} + \frac{w_1x^2}{2} + \frac{w_{10}(x-a)^2}{2} - C_3\sin\frac{x}{j} - C_4\cos\frac{x}{j} - (w_1+w_{10})j^2\right]$$

$$i = \frac{1}{P}\left[\frac{(M_2-M_1)}{L} - \frac{w_1L}{2} - \frac{w_{10}(b-a)(2L-a-b)}{2L} + (w_1+w_{10})x - w_{10}a - \frac{C_3}{j}\cos\frac{x}{j} + \frac{C_4}{j}\sin\frac{x}{j}\right]$$

CASE III — when $x > b$

$$M = C_5\sin\frac{x}{j} + C_6\cos\frac{x}{j} + w_1j^2 \qquad S = \frac{C_5}{j}\cos\frac{x}{j} - \frac{C_6}{j}\sin\frac{x}{j}$$

$$y = \frac{1}{P}\left[M_1 + \frac{(M_2-M_1)x}{L} - \frac{w_1x(L-x)}{2} - \frac{w_{10}(b^2-a^2)(L-x)}{2L} - C_5\sin\frac{x}{j} - C_6\cos\frac{x}{j} - w_1j^2\right]$$

$$i = \frac{1}{P}\left[\frac{(M_2-M_1)}{L} - \frac{w_1L}{2} + w_1x + \frac{w_{10}(b^2-a^2)}{2L} - \frac{C_5}{j}\cos\frac{x}{j} + \frac{C_6}{j}\sin\frac{x}{j}\right]$$

CONSTANTS

$$C_1 = \frac{M_2-w_1j^2}{\sin\frac{L}{j}} - \frac{(M_1-w_1j^2)-w_{10}j^2\left(\cos\frac{a}{j}-\cos\frac{b}{j}\right)}{\tan\frac{L}{j}} + w_{10}j^2\left(\sin\frac{a}{j}-\sin\frac{b}{j}\right) \qquad C_2 = M_1-w_1j^2$$

$$C_3 = \frac{M_2-w_1j^2}{\sin\frac{L}{j}} - \frac{(M_1-w_1j^2)-w_{10}j^2\left(\cos\frac{a}{j}-\cos\frac{b}{j}\right)}{\tan\frac{L}{j}} - w_{10}j^2\sin\frac{b}{j} \qquad C_4 = M_1-w_1j^2-w_{10}j^2\cos\frac{a}{j}$$

$$C_5 = \frac{M_2-w_1j^2}{\sin\frac{L}{j}} - \frac{(M_1-w_1j^2)-w_{10}j^2\left(\cos\frac{a}{j}-\cos\frac{b}{j}\right)}{\tan\frac{L}{j}} \qquad C_6 = M_1-w_1j^2-w_{10}j^2\left(\cos\frac{a}{j}-\cos\frac{b}{j}\right)$$

Table 1. Equations for single span

Now
IN OPERATION
on
EASTERN AIR LINES
and
DELTA AIR LINES

Economy of operation, dependable performance and advanced features of design, such as the new Wright Dynamic Damper which eliminates torsional vibration, are factors which have given Wright aircraft engines world leadership as power equipment for modern, high-speed transports on leading airlines throughout the world.

Wright "Whirlwinds" were selected to power the fleets of new 10-passenger Lockheed Electra transports recently placed in service on Eastern Air Lines and Delta Air Lines.

The swift, 210-mile-per-hour Electra is the newest member of the famous Lockheed line of airplanes. Powered by two economical Wright "Whirlwinds," each developing 450 h.p. for take-off, the Electra is one of the world's fastest and most luxuriously furnished bi-motored transports.

The "Whirlwinds" are of the celebrated line of Wright Engines which powered Colonel Lindbergh's memorable flight from New York to Paris, Kingsford-Smith's flight around the world, Admiral Byrd's flights over the North and South Poles, the Key brothers' world endurance record of 653 hours of sustained flight and many other famous ocean flights and endurance records.

WRIGHT

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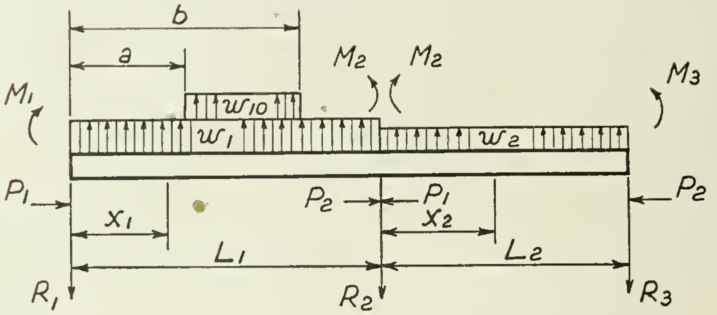
A DIVISION OF CURTISS-WRIGHT CORPORATION



$$\frac{M_1 L_1 \alpha_1}{I_1} + 2M_2\left[\frac{L_1}{I_1}\beta_1 + \frac{L_2}{I_2}\beta_2\right] + \frac{M_3 L_2 \alpha_2}{I_2} =$$

$$\frac{w_1 L_1^3}{4I_1}\gamma_1 + \frac{w_2 L_2^3}{4I_2}\gamma_2 + \frac{3w_{10}L_1^3}{4I_1}\left[\frac{\left(\cos\frac{a}{j_1} - \cos\frac{b}{j_1}\right)\csc\frac{L_1}{j_1} - \frac{(b^2-a^2)}{2j_1L_1}}{\left(\frac{L_1}{2j_1}\right)^3}\right]$$

Table 2

(Continued from preceding page)

Differentiating twice with respect to x,

$$\frac{d^2M}{dx^2} + \frac{P}{EI}M = w_1 \quad\text{[4]}$$

Letting $\frac{P}{EI} = \frac{1}{j^2}$,

$$\frac{d^2M}{dx^2} + \frac{1}{j^2}M = w_1 \quad\text{[5]}$$

Solving this differential equation,

$$M = C_1 \sin\frac{x}{j} + C_2 \cos\frac{x}{j} + w_1 j^2 \quad\text{[6]}$$

From [1] and [6], solving for the deflection y,

$$y = \frac{1}{P}\left[M_1 + \frac{(M_2-M_1)x}{L} - \frac{w_1Lx}{2} - \frac{w_{10}(b-a)\left(L - \frac{a+b}{2}\right)x}{L} + \frac{w_1x^2}{2} - C_1\sin\frac{x}{j} - C_2\cos\frac{x}{j} - w_1j^2\right] \quad\text{[7]}$$

$\frac{dy}{dx} = i$, slope of deflection curve

$$i = \frac{1}{P}\left[\frac{(M_2-M_1)}{L} - \frac{w_1L}{2} - \frac{w_{10}(b-a)\left(L - \frac{a+b}{2}\right)}{L} + w_1x - \frac{C_1}{j}\cos\frac{x}{j} + \frac{C_2}{j}\sin\frac{x}{j}\right] \quad\text{[8]}$$

$\frac{dM}{dx} = S$, shear

$$S = \frac{C_1}{j}\cos\frac{x}{j} - \frac{C_2}{j}\sin\frac{x}{j} \quad\text{[9]}$$

These equations are the same as those given in Table 1, with the exception of the term containing w_{10}, in which the form has been changed slightly by multiplying both numerator and denominator by 2.

Maximum Moment

Since the shear represents the slope of the moment curve, the point at which the shear is equal to zero will be a point of either maximum or minimum moment. The values of x for zero shear for each of the three cases can be obtained by solving the following equations:

Case I $-\tan\frac{x}{j} = \frac{C_1}{C_2}$

Case II $-\tan\frac{x}{j} = \frac{C_3}{C_4}$

Case III $-\tan\frac{x}{j} = \frac{C_5}{C_6}$

The value of x obtained from the above equations must lie within the limits of x for the case considered. It is probable that in only one of the three cases will this condition be fulfilled, and the value of x for this case will give the location of the section of maximum or minimum moment; if none of the cases meets this condition, then one of the end moments will be the maximum on the beam.

Equation of Three Moments

The application of the above formulae to the three moment theorem is obtained by equating the values of the slopes of the deflection curves for the two spans at the center support.

The first case considered will be the one most likely to be encountered, with the loading for the left-hand span the same as shown in Table 1, and a uniform load over the right-hand span.

For the right-hand span, the usual equations for a uniformly loaded beam with an axial load will apply, using the proper subscripts in the equations. The constants for the right-hand span will be denoted by a prime. At R_2, $x_1 = L_1$ for the left-hand span, and $x_2 = O$ for the right-hand span.

$$i_1 = \frac{1}{P_1}\left[\frac{(M_2-M_1)}{L_1} - \frac{w_1L_1}{2} + w_1L_1 + \frac{w_{10}(b^2-a^2)}{2L_1} - \frac{C_5}{j_1}\cos\frac{L_1}{j_1} + \frac{C_6}{j_1}\sin\frac{L_1}{j_1}\right]$$

$$i_2 = \frac{1}{P_2}\left[\frac{(M_3-M_2)}{L_2} - \frac{w_2L_2}{2} - \frac{C_1'}{j_2}\right]$$

C_5 and C_6 are given in Table 1.

$$C_1' = \frac{(M_3 - w_2j_2^2) - (M_2 - w_2j_2^2)\cos\frac{L_2}{j_2}}{\sin L_2/j_2}$$

To obtain the three moment equation, equate i_1 and i_2 at the middle reaction, substitute the values of the constants, combine

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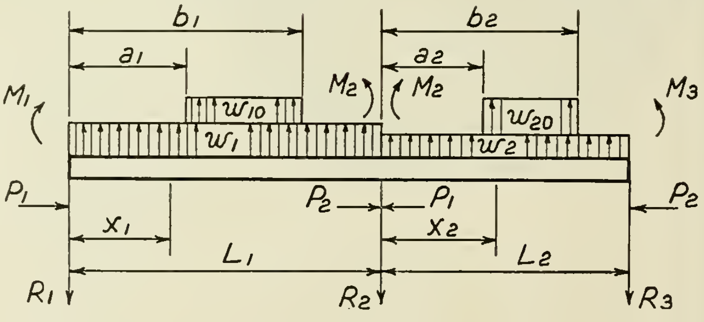

$$\frac{M_1 L_1 \alpha_1}{I_1} + 2M_2\left[\frac{L_1}{I_1}\beta_1 + \frac{L_2}{I_2}\beta_2\right] + \frac{M_3 L_2 \alpha_2}{I_2} =$$

$$\frac{w_1 L_1^3}{4I_1}\gamma_1 + \frac{w_2 L_2^3}{4I_2}\gamma_2 + \frac{3w_{10}L_1^3}{4I_1}\left[\frac{\left(\cos\frac{a_1}{j_1} - \cos\frac{b_1}{j_1}\right)\csc\frac{L_1}{j_1} - \frac{(b_1^2-a_1^2)}{2j_1L_1}}{\left(\frac{L_1}{2j_1}\right)^3}\right] -$$

$$\frac{3w_{20}L_2^3}{4I_2}\left[\frac{\left(\cos\frac{a_2}{j_2} - \cos\frac{b_2}{j_2}\right)\cot\frac{L_2}{j_2} + \left(\sin\frac{a_2}{j_2} - \sin\frac{b_2}{j_2}\right) + \frac{(b_2-a_2)}{j_2} - \frac{(b_2^2-a_2^2)}{2j_2L_2}}{\left(\frac{L_2}{2j_2}\right)^3}\right]$$

Table 3

RICHARD WHATHAM
B.S.
Vice-pres.; Meteorology Instructor

LT. COL. GEO. A. VAUGHN, JR., D.S.C., D.F.C., *Vice-pres.; Avigation Instructor*

CHAS. S. (CASEY) JONES
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LEE D. WARRENDER
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Vice-pres.; Director of Training

B. HUNT SMITH
Secretary & Treasurer

In Appreciation

To the aircraft and engine manufacturers, the airlines, and commercial operators—

WE, THE faculty, utilize this means to express our thanks for the confidence you have placed in us, our training, and—more particularly—in our graduates. « « One year ago, in this magazine, we recounted for your approval, the progress made by the Casey Jones School of Aeronautics—a move to larger quarters, the addition of several new courses, a sheet metal and heat treating department, the acquisition of new equipment, a larger faculty, our own wind tunnel, etc. « « In conclusion we stated: *"The confidence we place in the value of our graduates to the industry is based on our own mature judgment of, and our cumulative experience in, the matter of employment requirements. With this advance knowledge of the manufacturers' and the operators' needs, we invite your cooperation and consideration as the industry expands."* « « Little did we realize how heartily you would respond, how often, and how many of our graduates by this time would be on your payrolls from coast to coast « « Again, our thanks. And our assurance that we will continue to merit your confidence—by increased efforts, constant improvement and rigid admission requirements.

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Welding Instructor

GEO. H. CALDWELL
Metal Shop Instructor

(*Continued from preceding page*)
terms and simplify. The resulting equation is then multiplied by 6, and α, β and γ are substituted for the terms they represent, reducing the equation to the form shown in Table II. In this equation, with subscripts for L and j corresponding to the spans,

$$\alpha = 6\left[\frac{\frac{L}{j}\csc\frac{L}{j} - 1}{\left(\frac{L}{j}\right)^2}\right]$$

$$\beta = 3\left[\frac{1 - \frac{L}{j}\cot\frac{L}{j}}{\left(\frac{L}{j}\right)^2}\right]$$

$$\gamma = 3\left[\frac{\tan\frac{L}{2j} - \frac{L}{2j}}{\left(\frac{L}{2j}\right)^3}\right]$$

This equation is the same as the equation given on page 191 of *Airplane Structures,* except that there is an additional term for w_{10}. As a check, when $b = L_1$ and $a = o$, the term containing w_{10} becomes the same as the term containing w_1.

Short Load on Both Spans

In the second case considered the loading on both spans is of the type shown in Table I.

For this case, the equations for i_1 and i_2 and for the constants C_5, C_6 and C_1 can all be taken from Table I. Equating i_1 and i_2 at the center support and substituting as before, the equation obtained reduces to the form shown in Table III, in which α, β, and γ have the same significance as in the preceding case. As a check, when $a_1 = O$ and $b_1 = L_1$ the term containing w_{10} becomes the same as the term containing w_1, and when $a_2 = O$ and $b_2 = L_2$, the term containing w_{20} becomes the same as the term containing w_2.

The sines, cosines and tangents of L/j, and the values of α, β and γ for various values of L/j, are given in Tables 11:1 and 11:3 of Niles and Newell.

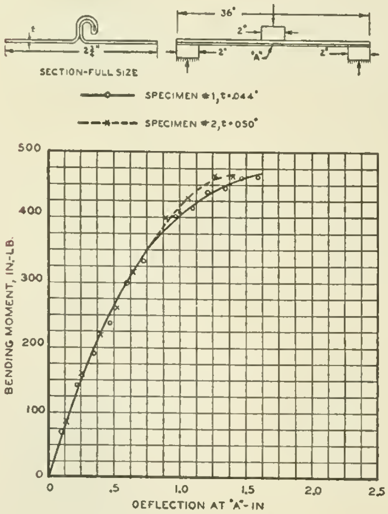
Fuel and Oil Tank Construction

●

PHILIP J. BILLIG, JR.

Chief Engineer, Paramount Welded Aluminum Products Corp.

● Several years of recent experimental work, backed by 18 years of experience in the aircraft industry specializing in the manufacture and design of fuel and oil tanks, has resulted in the production of a new-type aluminum alloy tank by the Paramount Welded Aluminum Products Corp., Brooklyn, N. Y. Featuring greater flexibility, structural strength and a new method of fastening internal construction, this design can be applied to any size or shape of tank in any construction.

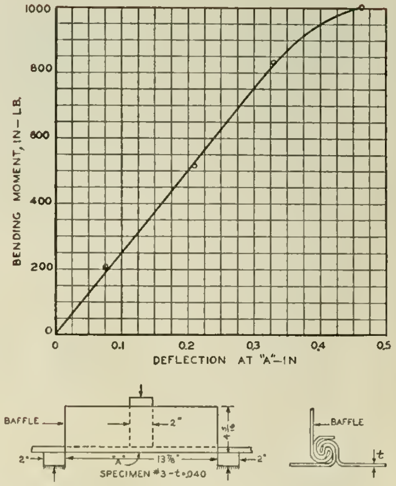


Bending tests on the tank body

Flexibility is achieved through a hook type rocker action track joint on which the tension and compression members or bulkheads are fastened. In the old-type tank, this internal structure is usually fastened by riveting the above to the skin, thus producing the more rigid type of tank which very often experiences skin fractures or tearing away of rivet or bulkhead flanges from the skin.

This new design upon which patents are pending, has eliminated causes of fracture or rupture from these sources and this is evidenced by the fact that recently the tank withstood 100 hours of continuous vibration tests and 80 percent overload on a drop test. This design also eliminates the necessity of "protruding rivets" (rivets through the skin) for fastening the interior structure, or structural members to the skin. Since external riveting is no longer necessary, beading also becomes obsolete, inasmuch as the beading is only used for the purpose of taking up the expansion and contraction of the aluminum when rivets are welded to the skin.

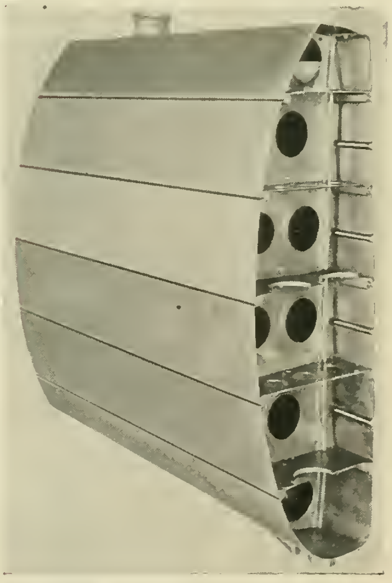
The baffle contains a tail-like section which rides and sets over the track section of the body in such a way that it takes up all compressions transmitted from any portion of the tank or structural members to the bulkhead joint.



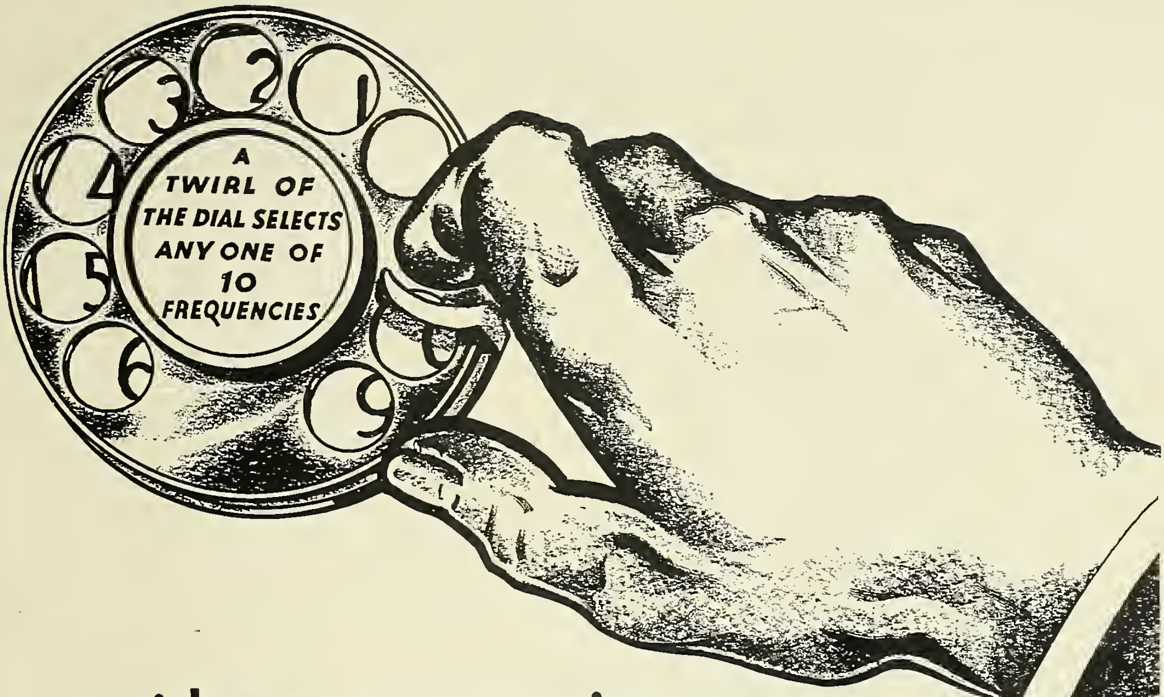
Bending tests on the body and baffle joints

The heads of the tank are fastened in the same manner as the bulkheads, which are interlocked with the baffles through the hook type rocker action track joint, thus tying all tank baffles and heads into one solid.

Production will be maintained in a new complete and modern factory building which has been laid out to provide economical fabrication on a quantity production basis. It has been equipped with special machines and tools, among them being 100-ton armor plate presses which produce the special hook type rocker action track joint, the exclusive feature of the tank. In conjunction with this press, there are compound dies which also aid in the fabrication of this joint.



Paramount aluminum alloy tank showing hook type rocker action track joints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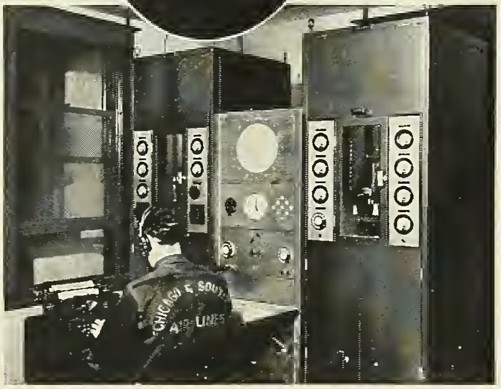

St. Louis ground station of Chicago & Southern Air Lines. 400 Watt Western Electric 14B Transmitter at right, 9B Rectifier at left, control apparatus in center. Western Electric remotely controlled Receiver (not shown) is also used. Chicago & Southern operates similar installations at Jackson, Miss., and Memphis, Tenn.

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TWO-WAY AVIATION RADIO TELEPHONE AND TELEGRAPH EQUIPMENT

Soundproofing of the Martin 130 "China Clipper"

●

DR. CARL A. FRISCHE
Acoustical Engineer, Sperry Gyroscope Company, Inc.

● Short flights rarely result in discomfort among passengers for frequent stops usually provide any needed relief from fatigue, vibration or noise. In these cases the accumulated effect of hours of flying is not realized, but on flights over considerable distances where scheduled stops are seldom made, it is important that steps be taken to provide for passenger comfort. This is particularly so of the *China Clipper,* the Martin flying boat which soon will go into transpacific service and which must cover 2410 miles of open water on the first leg of its trip.

Sperry acoustical engineers were entrusted with the task of soundproofing the spacious ship for which Pan American Airways and the Glenn L. Martin Co., specified an average noise level of 70 db.

With the store of experience gained by long research and by practical application of the Douglas Transport, Curtiss-Wright Condor and several foreign planes, we approached the job. The most useful instruments for investigating this type of acoustic problem are noise meters and frequency analyzers. A noise meter is a device for converting acoustical energy into electrical energy so that sound intensity at any point may be conveniently read upon a meter. This noise meter consists of a microphone for picking up the sound, an amplifier for amplifying the enegry, and an electric meter (such as a micro-ammeter) which measures the power output of the amplifier. Its scale is calibrated in decibels, the scale being defined by the equation,

$$\text{db} = 10 \log \frac{I}{I_0}$$

where I_0 is some fixed reference level (the reference level chosen by the Acoustical Society of America is 10^{-16} watt/cm^2; I is the acoustic energy in watts/cm^2). If the amplifier is equally sensitive to all frequencies, we will have what is known as an *intensity meter.* However, the sensitivity of the human ear varies with frequency as well as with intensity so that sound intensity is not a true indication of the loudness of a given sound. Figure 1 shows equal loudness contours for different frequencies and different intensity levels. From these curves it is evident, for example, that if a particular sound is made up of frequencies ranging from 200 to 2000 cycles at levels from 60 to 100 db, intensity measurements will give a good indication of the loudness.

Seldom, (and never in airplanes) is there such a frequency distribution, and so some provision must be made if the meter is to indicate loudness instead of intensity levels. This may be achieved in two ways. If a filter network is incorporated in the sound meter so that the meter frequency sensitivity is the same as the ear's, the meter will indicate loudness levels. Such a filter network is called a "weighing" network, and from the curves of figure 1 it is evident that such a network can only be made for one particular intensity level. For airplane work, where the loudness level is from 60 to 70 db after soundproofing, a 60 db frequency "weighing" network is usually used.

Another method of obtaining loudness levels is to use an *intensity* meter with a set of band pass filters so that an actual frequency distribution of the noise intensity in the airplane may be obtained. Knowing the frequency distribution we may calculate the loudness level from the curves of figure 1.

Although the loudness level is a good indication of the quietness of a given airplane, it is of little value in the actual soundproofing problem for the data which are most useful and of fundamental value are the noise frequency analyses. In order to obtain this data an intensity meter is used in conjunction with a frequency analyzer, the latter consisting of a set of electrical band pass filters. With this instrument it is possible to choose any particular frequency band, say from 64 to 128, or 512 to 1024 cycles per second, and measure the noise intensity in these particular bands. Figure 2 shows such a frequency distribution curve, each step representing one band on the acoustic analyzer.

It might be concluded that in order to obtain a better picture of the frequency analysis it would be desirable to have an analyzer with narrower band widths. However, several factors must be considered. If the bands were made too narrow it would be difficult to get steady readings since the various noises in an airplane are constantly changing in frequency. Also, if only a band pass filter of the "fixed band" type were used, more filters would be needed for they are narrower and must cover the same range. Thus the unit would not only be expensive but also bulky and heavy.

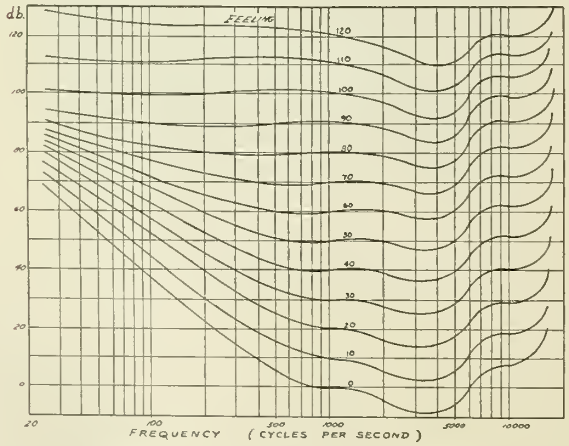


Fig. 1: Equal loudness contours for different frequencies and different intensity levels

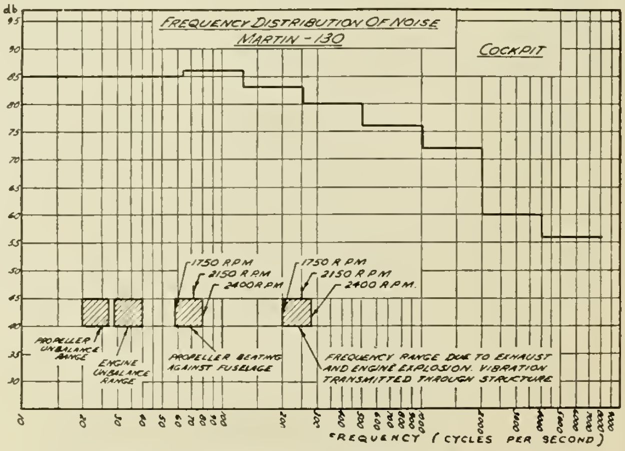


Fig. 2: Frequency distribution of noise in the pilot's cockpit showing frequency ranges of most probable sources of disturbance

The zero reference level for the noise measurements used in this article is 24.4 × 10^{-16} watts/cm^2 (millibar). This facilitates comparisons with previous work such as the Douglas DC-1 reported in the S.A.E. Journal for February 1934.*

The first question asked by an airline operator or plane manufacturer when confronted with the soundproofing problem is "How much weight will it take?" Before the soundproofing engineer can answer this question he must know:

1. The clearance between propeller tips and fuselage; the propeller tip speed; whether the propeller is two- or three-bladed; and if the propeller pitch is controllable or fixed.
2. The type of engines to be used; number cylinders; engine speed; total horsepower; the location of the exhaust stack outlets with respect to the wing and fuselage; and if the engines are mounted on flexible mountings.
3. The type of basic structure; if primary structure members run through cabin; and if the floor takes loads.
4. The number of windows in the cabin and the ratio of window area to total area in the cabin.
5. The plans for interior trim and weight allowance for such trim.
6. Number of passengers to be carried.
7. Whether cabin is isolated from other parts of the ship by doors.
8. Whether the soundproofing is to be removable for structure inspection.
9. What provision has been made to prevent bulkheads from drumming.

When these facts are determined, the acoustical engineer is in a fairly good position to make a rough estimate of the weight necessary.

The Sperry engineers working in close cooperation with the Martin engineers, undertook to soundproof the *China Clipper* with a maximum of 600 lbs. Since the original plans of the ship did not call for soundproofing, it was necessary that the weight allowance for interior trim be taken out of the soundproofing allowance. Furthermore, Pan American Airways wished the soundproofing to be removable to permit rapid inspection of the structure. At first this specification seemed to be a major obstacle from the soundproofing standpoint, but it was partially solved by the insertion of Talon fasteners in the doped fabric interior. The materials cemented to the skin were quilted between layers of light cloth so that they would not tear when pulled away from the structure. It was also necessary to provide a flexible cement for fastening these materials to the structure so that they might be readily peeled off without injury.

In connection with the weight problem it is interesting to review the breakdown of the soundproofing weight allowance as shown in the weight schedule (in pounds) given in Table I.

Table I

Fibrous soundproofing materials	300
Interior fabric and dope	60
Sound deadening paint	11
Cement for attaching soundproofing materials	70
Kick plates behind fabric interior	10
Cabin door	7.50
Talon fasteners	32.90
Moulding strips, screws, bulkhead stiffeners, etc.	62.21
Total soundproofing weight allowance	553.61

This table gives an idea of the size of the ship and is illuminating from the standpoint of accessory weight. Originally, the inboard exhaust stacks were lengthened in the hope of utilizing the wings as a shield. However, since it was found that these extensions did not decrease the noise level perceptibly, they were omitted. The above schedule does not include weight allowances for cockpit soundproofing, and when this is added at a later date, the soundproofing weight will be brought up to slightly more than 1% of the gross weight (51,000 lbs.) of the plane.

The acoustic flight tests of the *China Clipper* may be divided into three groups. The first set of measurements was taken in the untreated ship. Then the #2 compartment was treated and provided with temporary doors. Check flights were then made on the noise reduction of this compartment and compared to the noise in the other parts of the ship. The third and final checks were made on the completed installation.

The noise levels in various parts of the ship before treatment are indicated by the black circles in figure 3 and these readings represent averages of several sets of measurements. The readings in #2 compartment taken on the check flights of the untreated ship were consistently 1 to 2 db lower than either of the compartments fore or aft, but it was found that life preservers, overcoats and other paraphernalia were stored in this compartment. The reduction in noise at this station was due to the absorption of sound by these items.

It is to be expected that the cockpit and the galley are the two noisiest sections of the ship, for they lie near the plane of rotation of the propellers, which frequency data show are responsible for the largest portion of noise.

Figure 3 also shows the loudness levels of the noise at various stations after soundproofing including the compartments which are made up for sleeping, and are denoted by U for upper berths and L for the lower berths (numbers indicated in black circles are readings before soundproofing). At the time these readings were taken, sleeping berths were temporarily installed in the lounge compartment, although in the present ship no sleeping accommodations are provided in this section. It is observed that #1 compartment is the noisiest with several factors contributing to this condition. The forward portion of this compartment is nearest to the plane of rotation of the propellers, the galley is only semi-soundproofed, and the flight mechanic's compartment (which is not yet soundproofed) is directly overhead. However, subsequent soundproofing of the cockpit and flight engineer's compartment will improve this situation. Tests indicated that the loudness levels with the ship in day conditions differed very little from those in night conditions. In the day setup, levels at various stations were about the average of readings taken in the upper and lower berths for the night condition. This might be expected since the absorption is already high, and the night curtains and other paraphernalia add relatively little absorption, especially in the frequency range below 500 cycles.

Table II shows the loudness levels (in db) measured in the ship with only #2 compartment soundproofed:

Figures 2 and 4 show the frequency distribution of the noise in the various compartments, as noted on the graphs. Figure 2 showing the frequency distribution of noise in the pilot's compartment has marked off on the bottom of the chart the frequency ranges of the most probable sources of disturbance, and it will be

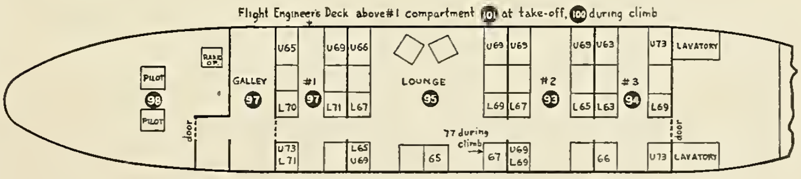


Fig. 3: Noise levels before and after soundproofing

noted that the frequency range from 64 to 128 cycles predominates. This disturbance coincides with the most probable frequency generated by the beat of the propellers against the skin, this frequency being given by the equation

---

* The reference level recently adopted by the Acoustical Society of America is 10^{-16} watts/cm^2.

$$f = \frac{\text{number of blades} \times \text{r. p. m.}}{60}$$

Assuming a propeller r. p. m. of 1430, we get:

$$f = \frac{3 \times 1430}{60} = 71 \text{ cycles/sec.}$$

From the graph one might conclude that the propeller and engines were usually rough since the intensity level from 0 to 64 cycles is also high. However, this assumption is not correct. Close inspection of figure 2 shows that the frequency band from 59 to 80 cycles, corresponding to the propeller noise, lies almost on the border line between the 0 to 64 and the 64 to 128 cycle band. There is naturally some over-lapping of the filter bands. Also, there are many unstressed light duralumin panels such as partitions, etc., which have resonance frequencies below 64 cycles, and in such a condition are efficient sound radiators. The exhaust noise is of secondary importance to that of the propellers. This is in part due to the fact that the exhaust is partially shielded from the cabin, by the wing. Calculations from figure 2 show that about 90% of the noise energy is in the frequency range below 500 cycles, and it is well shown that this part of the acoustic spectrum is hardest to treat.*

The line A in figure 4 shows the frequency distribution of noise in the lounge, just forward of the soundproofed compartment during flight test. This is similar to figure 2 except that the noise in the exhaust frequency range at this point is a little higher. Line B shows the frequency distribution in the soundproofed compartment, and indicates that the noise in the 0-64 cycle range has been reduced considerably. Most of this reduction is accomplished by cementing sound deadening material to the metal panels. The reduction in noise in the ranges above 64 cycles can be ascribed to both sound deadening and to actual acoustic absorption.

Line C shows the frequency distribution in the aft compartment (#3), and a comparison between it and line B is illuminating. The noise in the 0-64 cycle band in #3 compartment is very little higher than the noise in the same frequency band in the soundproofed compartment. Since there is no absorption in compartment #3, it must be assumed that a large portion of the noise in the 0-64 cycle band is transmitted back through the structure. This vibration can only reach compartment #3 through compartment #2. However, the structure in compartment #2 was deadened and thus the vibration reaching compartment #3 was reduced considerably. This demonstrates once more that most of the noise in airplanes is transmitted through the structure.

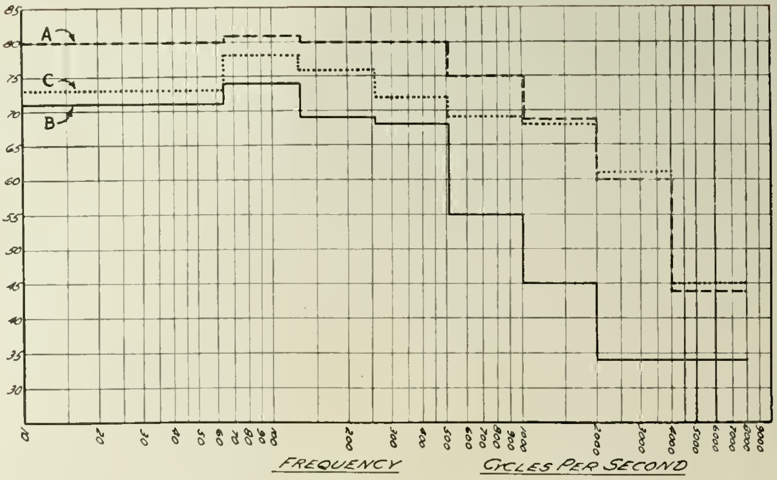
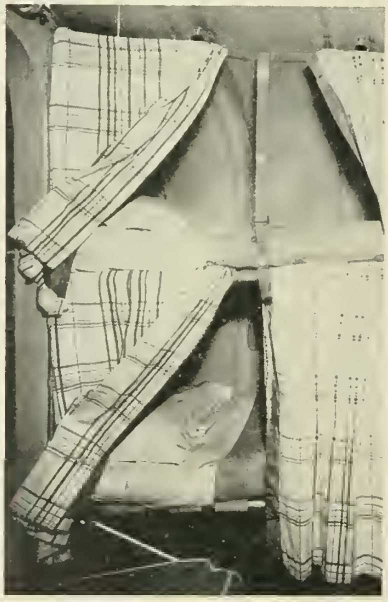


Fig. 4: Noise frequency distribution (A) lounge, (B) soundproofed compartment, (C) aft compartment



Portions of the sleeping berths in the Martin 130, showing soundproofed walls

Table II	
Cockpit	96
Lounge (1st compartment forward of soundproofed cabin)	91
#2 compartment soundproofed	75
#3 compartment aft of soundproofed compartment	80

The loudness levels recorded (in db) on the flight test with #2 compartment soundproofed, are given in Table III. The reduction of noise in that compartment was considered satisfactory in view of the fact that the other cabins were not soundproofed.

Table III	
Cockpit	96
Lounge	91
#2 compartment	75
#3 compartment	90

The complete installation was then made, with the exception of the cockpit.

The frequency distribution of the noise in the lounge compartment, all others being fully soundproofed, may be taken as representative of the soundproofed portion of the ship, except that the levels are all a trifle higher in the #1 compartment, the predominating frequency being in the range from 64 to 256 cycles. Obviously, if the noise were to be further reduced we would have to concentrate on this frequency band. However, absorption in this band is already high and so no appreciable reduction can be obtained by increasing it. Since inspection of figure 2 shows that the propellers are responsible for a major portion of this disturbance. In this case the only recourse would be to increase the propeller clearance. Here again, difficulties are encountered because this operation involves considerable increase in weight.

Passengers travelling on the *China Clipper* will be little concerned about acoustic data. Their primary interest will be in the actual comfort experienced during flight, and the ease with which a conversation may be carried on in the ship. A person sitting anywhere in the lounge may easily carry on a conversation with another passenger in the lounge; at night he may retire and be assured of undisturbed sleep.

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*Ibid.

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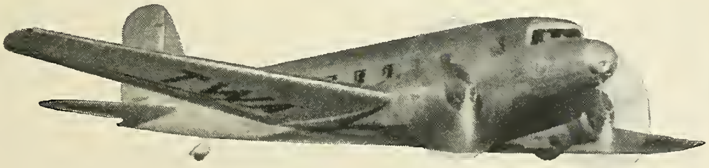

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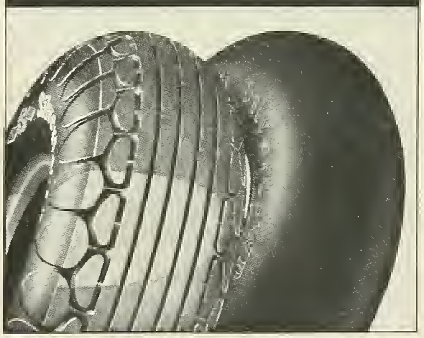

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The Four-Place Warner Super Scarab-Powered Cessna C34 Cabin Monoplane

●

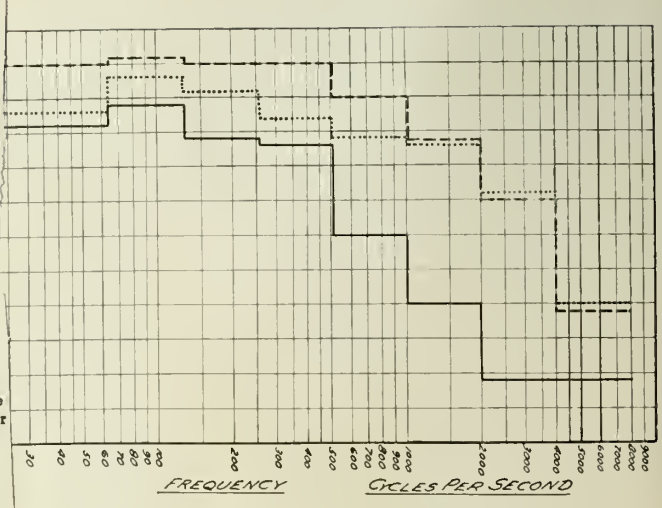
● The C34, latest development of the Cessna Aircraft Co., is a four-place cabin monoplane designed for fast, economical transportation. Powered by the 145 h.p. Warner Super Scarab engine and equipped with a Hartzall wood propeller, the plane cruises 143 m.p.h. at sea level with full load and at a fuel consumption of 9.5 gal./hr., which is equal to 16 miles to the gallon.

Aerodynamically cleaner in appearance than previous Cessna models, the C34 displays many improvements including full cantilever construction in the wing, empennage, and landing gear. It is brought further up-to-date by the utilization of a combination parking brake and rudder lock, wing flaps, longitudinal trimming tabs, electric starter, and an NACA cowl with pressure baffling. Navigation lights are also provided.

Construction Details

The fuselage structure is of welded steel tubing covered with fabric and dural. Arrangement of the cabin provides dual controls and two double seats in tandem, with the throttle located in the center of the instrument panel within easy reach of the occupant of either front seat. A conveniently-located steel tube step, an exceptionally wide door, ample leg and head room facilitate easy entrance and egress. Visibility is enhanced by a well-rounded windshield and wide side windows. The standard interior is upholstered in Bedford cord, a two-tone color combination being obtainable at no additional cost to the purchaser. Standard instruments include a compass, fuel gauge, oil pressure gauge, oil temperature gauge, tachometer, airspeed indicator, and altimeter.

An NACA 2412 airfoil section has been used for the fabric-covered wing which tapers in thickness and planform, with the chord varying from 84 inches to 56 inches. Spars are of solid spruce with several laminations in each and are continuous from tip to tip, a construction which combined with the double drag wire bracing and reinforced plywood, makes for rigidity and strength. Ribs are also of spruce and the elliptical tips of the wing and the nose are covered with plywood. Flaps, of the trailing edge type, are operated by a worm gear irriversible system and extend from the



ency distribution (A) lounge, (B) soundproofed compartment, (C) aft compartment

●

Outlines of the 145 h.p. Warner Super Scarab Cessna C34

●

#3, it must be assumed tion of the noise in the d is transmitted back ture. Thi

The loudness levels recorded (in db) on the flight test with #2 compartment soundproofed, are given in Table III. The reduction of noise in that compart-

ailerons to the f[illegible] Ailerons are of the Friese type, [illegible]ly balanced and cable actuated. The[illegible] are mounted directly on the rear spar of the wing.

Tail surfaces are of conventional Cessna construction and there are tab controls on both elevators. The rudder, like the ailerons, is cable-actuated.

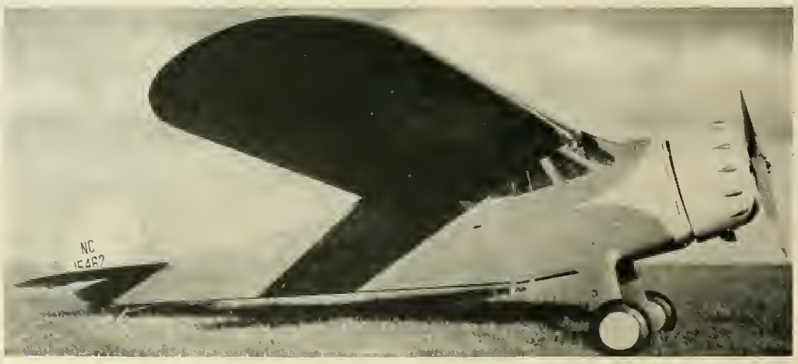
Equipped with an oildraulic spring-type shock absorber, the landing gear has a total vertical travel of 6 inches. A new-type link system replaces the usual splines which keep the shock absorber piston from rotating in the barrel. The entire link is mounted on grease sealed ball bearings and the undercarriage assembly is heat-treated, all machine work being done after the heat treatment. Sliding parts have a ground finish. The tail wheel is of the fully-swiveling type and is equipped with an oildraulic spring shock absorber and an 8-inch Goodyear streamline tire. Landing gear tires are of General manufacture and the wheels and brakes are Autofan.

The Warner engine is [illegible] in a rubber suspension mount, and provision is made for 35 gallons of fuel and 3.5 gallons of oil.

Specifications

Specifications and performance figures of the Cessna C34 with the Warner Super Scarab engine are as follows:

Wing span	33 feet 10 inches
Length overall	24 feet 10 inches
Wing area	180.5 square feet
Aileron area	6.06 square feet
Stabilizer area	16.2 square feet
Elevator area	12.28 square feet
Fin area	5.2 square feet
Rudder area	6.1 square feet
Oil capacity	3.5 gallons
Fuel capacity	35 gallons
Maximum speed	162 miles per hour
Cruising speed	143 miles per hour
Landing speed	47 miles per hour
Service ceiling	18,900 feet
Rate of climb (sea level)	1000 ft. per min.



Full cantilever construction is a feature of the C34 which cruises at 143 m.p.h.

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CURRENT PRACTICE IN INSTRUMENT PANEL LAYOUT

(Continued from the October issue)

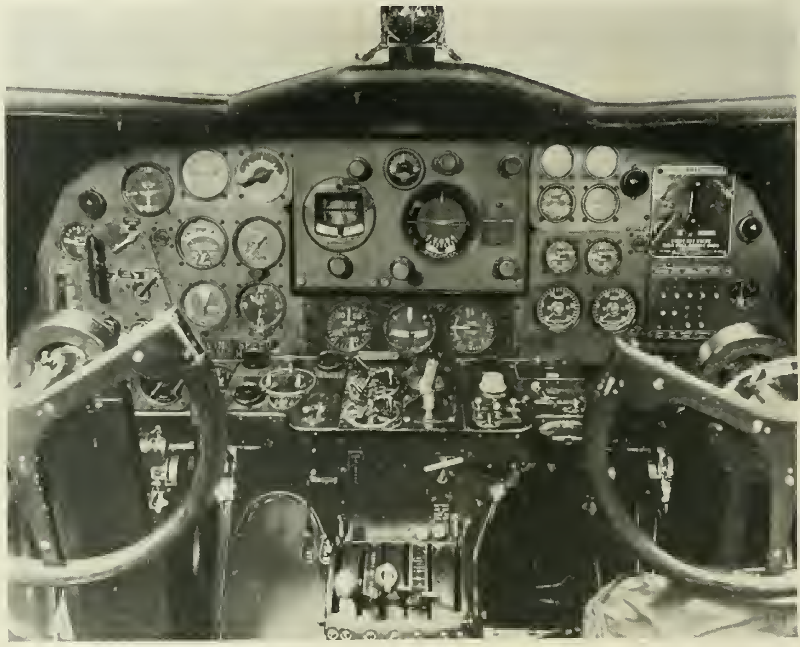
● Departures are sometimes made from standard instrument panel installations and arrangements to meet specific needs and particular desires of individual pilots. In some instances the experience gained in continuous operation of a plane dictates a change in the panel. The change may necessitate a complete rearrangement of the panel, and in these cases, the converted arrangement bears little resemblance to the model designed by the manufacturer in similar airplane types. This is particularly true of transport equipment where one operator usually has a preference for one arrangement, whereas another operator prefers an entirely different arrangement.

Although the standard placement of instrument panels of planes included in the following already have been described, the installations included here are so widely different from "standard" that they warrant special discussion. As in the previous articles, instruments are referred to reading from left to right, and from top to bottom.

Boeing 247-D

The new Boeing 247-D transports operated by United Air Lines carry a seven-sectioned panel completely redesigned from the type described in the first installment of this series. There is now a complete Sperry gyropilot unit in the center, and to provide space for this larger unit, it has been necessary to move the sensitive altimeter, manifold pressure gauge, and clock to other positions on the panel. The Pioneer airspeed, turn and bank, and rate of climb indicators retain their same relative positions as before, but now are placed on a separate panel. The compass is also in the same position on the top of the cockpit cowl directly at the center of the windshield.

Left panel: Pioneer wheel position indicator, Motometer air temperature gauge, fuel tank selector switch; de-icer air pressure gauge, fuel gauge selector switch, Lewis thermocouple, Kollsman sensitive altimeter; parking brake lever, intake manifold pressure gauge switch, Pioneer manifold pressure gauge, Pioneer-Waltham clock; fuel tank quantity gauges, Pioneer altimeter.



Boeing 247-D instrument panel

Right panel: Pioneer fuel pressure gauges (2); Pioneer oil pressure gauges (2); Lux fire extinguisher control for right and left engines; Pioneer oil temperature gauges (2); Weston electrical tachometers (2); switch bank for compass, navigating instruments, engine instruments, pitot heater, navigation lights, cabin, dome, courtesy, and stewardess call button; Weston ammeter.

Below the main panel and attached to it at approximately right angles is a three-sectioned horizontal auxiliary control board.

Left auxiliary panel: Navigation and engine instrument and compass light rheostats, engine switches, cabin information light switch, landing light switch.

Center auxiliary panel: Fuel tank selector switches, radio tuning dial, elevator flap adjustment control handle.

Right auxiliary panel: Radio volume control rheostats, radio fuse box, selector switches for radio transmitter or receiver.

Beechcraft B17L

A. C. Bostwick's Jacobs-powered Beechcraft B17L has a flight panel which was installed by Standard Aircraft Equipment Co., of Roosevelt Field. Here the instruments are arranged so that they appear to be on a single panel, although there is a second panel attached to the main board. In the descriptions of the instruments in this and the other planes which follow, the type designations of the various instruments are indicated in brackets. The Standard Aircraft Equipment company also rearranged and installed the panels of the three planes next described.

Instruments in Bostwick's Beechcraft are arranged as follows: Pioneer airspeed indicator (354), Pioneer turn and bank indicator (A-385), Pioneer rate of climb indicator (373-13), Kollsman compass (132), Pioneer tachometer (347), Pioneer manifold pressure gauge (791-B), Pioneer-Waltham clock (544); Kollsman sensitive altimeter (205), Sperry directional gyro, Sperry gyro-horizon, landing gear control handle, throttle, Kollsman oil temperature gauge (143), Pioneer oil temperature gauge (505), Pioneer carburetor temperature gauge (913); landing gear ammeter, tail wheel lock handle, manifold heater control, fuel tank selector valve, mixture control, primer, navigation light toggle switch, ammeter, cabin heater control.

Stinson Reliants

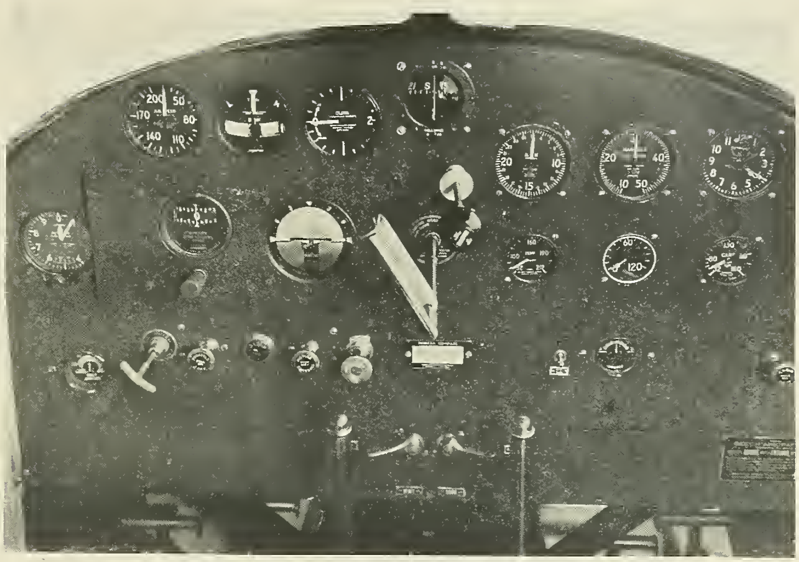
The Lycoming-powered Stinson Reliants owned by D. W. Bostwick and Northern States Airways, Inc., provide a comparison of different arrangements of similar panels. In both instances the instrument board is divided into three panels set into the main unit, the top left part remaining similar, particularly in the lower portion where the various controls are located. The right panel can be used as a map case or radio compartment. The arrangement of Bostwick's instrument panel follows:

Left panel: Pioneer-Elgin clock. Below are the heater control, manifold heat control, starter, mixture control; ignition switch, primer, landing light toggle switches, instrument light toggle switch, Lycoming-Smith propeller pitch control handle; landing flare release box.

Center panel: Pioneer airspeed indicator (354), Pioneer turn and bank indicator (385B), Pioneer rate of climb indicator (374B); Kollsman sensitive altimeter (76-01), Sperry directional gyro, Sperry gyro-horizon; National oil pressure gauge, Pioneer tachometer (347), Pioneer manifold pressure gauge (791B), National oil temperature gauge. Directly below this panel and attached to the main board are the Pioneer carburetor heat gauge (913), and Weston thermocouple indicator (602).

A Pioneer compass (744) is installed in the roof of the cabin, and the instrument light rheostat, airspeed indicator light rheostat, and fuel tank selector switches are at the lower right of the main panel. Directly below and under the entire panel is the radio.

Northern States Airways installation follows:



A. C. Bostwick's Beechcraft B17L instrument panel arrangement

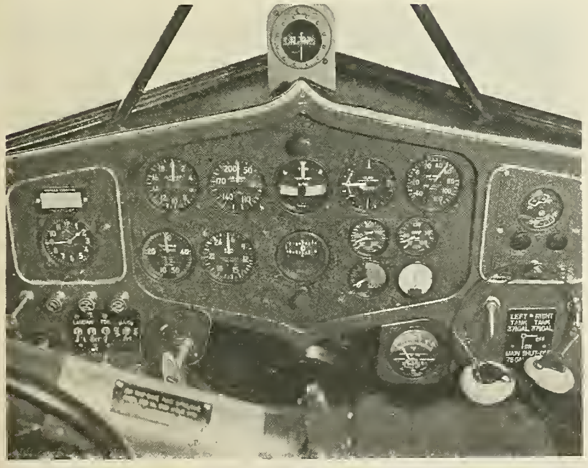
Left panel: Pioneer-Waltham clock. Below on the main panel are the heater control, manifold heat control, starter, mixture control; ignition switch, landing light toggle switches, instrument light toggle switch, and the Lycoming-Smith propeller pitch control handle.

Center panel: Pioneer altimeter (355C), Pioneer airspeed indicator (354), Pioneer turn and bank indicator (385B), Pioneer rate of climb indicator (374B), Kollsman air temperature gauge (147-02); Pioneer manifold pressure gauge (791B), Pioneer tachometer (347), Sperry directional gyro, Pioneer oil temperature gauge (506B), Pioneer carburetor heat gauge (913), Pioneer oil pressure gauge (505B), and Weston ammeter.

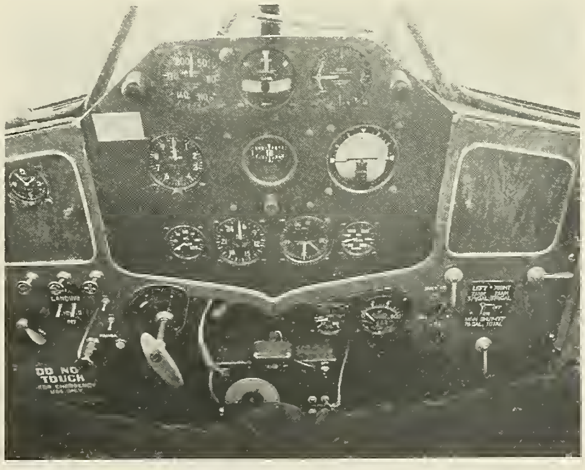
Right panel: RCA radio installation; fuel tank selector switches.

A Lewis thermocouple is at the right below the center panel and the Pioneer compass (718B) is directly above on the center line of the panel.

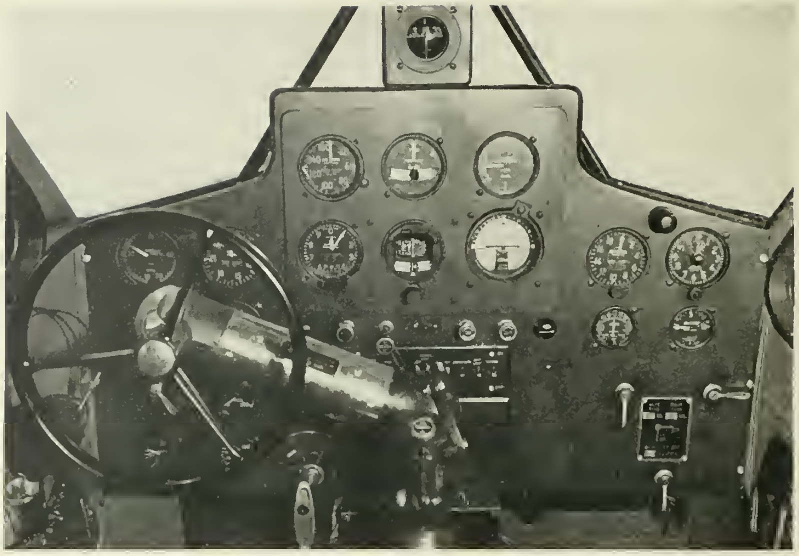
Another arrangement of a Lycoming-powered Stinson Reliant is illustrated in the panel of the plane owned by the New York *Daily News.* Completely rearranged, this installation is entirely different from other Stinsons both as to the shape of the panel and the arrangement of its instruments. The main panel contains at the left the Pioneer manifold pressure gauge (791B), Pioneer tachometer (347); Weston air temperature gauge (602), Weston thermocouple indicator (602); Pioneer ignition switch (EJ), National oil pressure gauge, Lycoming-Smith propeller pitch control handle. At the right are the Pioneer al-



Panel designed for Northern States Airways' Stinson



Arrangement of instruments in D. W. Bostwick's Stinson



Stinson Reliant panel rearranged for the New York "Daily News"

timeter (355C), Pioneer clock (880B); Weston ammeter, Pioneer suction gauge (763).

Center panel: Pioneer airspeed indicator (354), Pioneer turn and bank indicator (385B), Pioneer rate of climb indicator (374B); Kollsman sensitive altimeter (205-01), Sperry directional gyro, Sperry gyro-horizon. The airspeed indicator and gyro-horizon are equipped with Pioneer ring lights.

Directly below the center panel are the instrument light rheostats, heater control, mixture control, manifold heat control, and a bank of toggle switches for the lights. A Pioneer compass (780B) is above the center panel, and the fuel tank selector switches are at the lower right of the main panel.

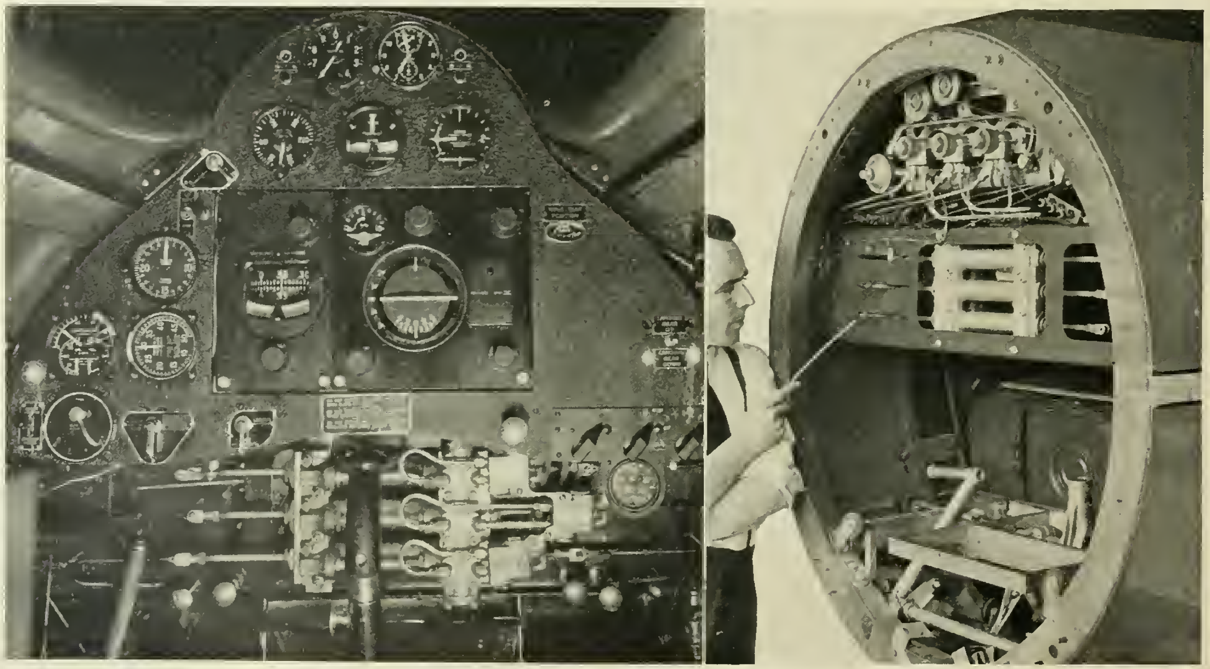
Detroit "News" Lockheed Orion

James Piersol, aviation editor of the Detroit *News* and pilot of the "Early Bird," the paper's Wasp-powered Lockheed, designed the instrument panel of this plane which was especially built for the varied work necessary in the gathering and reporting of news events. The center of the main panel is occupied by a Sperry gyropilot installation, including the directional gyro and gyro-horizon.

Above the center panel are the Kollsman sensitive altimeter, Jaeger clock; Pioneer airspeed indicator, Pioneer turn and bank indicator, Pioneer rate of climb indicator. To the left are the flap motor toggle switch, Pioneer tachometer; Kollsman engine gauge unit combination oil, fuel and temperature indicator, Kollsman manifold pressure gauge; starter-booster toggle switch, Scintilla ignition switch, vacuum pump-venturi switch, engine pressure-vacuum switch.

A wing flap position indicator is at the right of the gyropilot and the landing gear position lights are at the extreme right of the panel. Below these lights are the gyropilot servo-speed control valves, and the Sperry oil pressure gauge for the gyropilot.

The plane carries camera and radio equipment. A gun sight mounted on the windshield acts as a viewfinder for the wing camera; photographs are snapped by pressing a trigger on the control stick. Radio equipment includes a new-type transmitter, which is used as an auxiliary of WWJ, the News' radio station, in broadcasting outdoor events. The set covers a range of 1000-6000 kc. and it transmits both voice and code and can be operated from either the cockpit or cabin. A complete description of the plane appeared in the February, 1935 issue of Aero Digest.



Cockpit of Detroit "News" Lockheed showing arrangement of panel. Right: J. Piersol indicating the gyropilot servo control mechanism

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Wing Flutter

Instantaneous Development of the Problem of Wing Flutter (Augenblicklicher Entwicklungsstand der Frage des Fluegelflatterns), H. G. Kuessner. Luftfahrtforschung, Vol. 12, *No.* 6, *October* 3, 1935, *pp.* 193-209, 23 *figs., bibliography.*

METHODS FOR investigating wing flutter in airplanes, which have hitherto been thought practical, are considered and the results of observations of flutter on thirteen airplanes of various types are presented. The relations between reduced frequency, damping, and amplitude ratio are analytically treated under a simplified hypothesis and compared with empirical formulas. The author attributes the most immediate cause of wing flutter to unbalanced ailerons. In order to control flutter to the phase angle most suitable for the excitation with only two degrees of freedom, he suggests that the lowest critical speed be evaluated from the results of vibration tests. He recommends precautions to be followed in increasing the critical speed and for the complete prevention of flutter.

Airplane Strength Specifications

Remarks on the Strength Specifications for Airplanes (Bemerkungen zu den Vorschriften fuer die Festigkeit von Flugzeugen), A. Neesen and A. Teichmann. Luftwissen, Vol. 2, *Nos.* 8 *and* 9, *August and September,* 1935, *pp.* 201-214 *and* 251-254.

AIRPLANE STRENGTH requirements issued by the German Air Ministry for 1935 are considered and possibilities for improvements suggested. The authors discuss the loads which an airplane sustains in the air during squalls as well as under ordinary conditions of flight, the stresses set up in landing, rolling and towing on the ground, and those arising from centrifugal forces and hoisting. They also include data for carrying out strength tests.

Airplane Stability

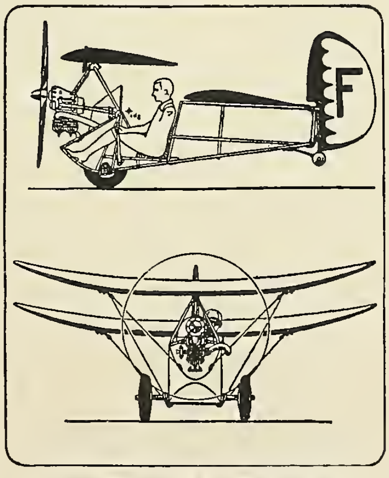
Automatic Stabilization (La stabilisation automatique), F. Haus. L'Aéronautique, Vol. 17, *No.* 197, *October,* 1935, *(Bulletin L'Aérotechnique), pp.* 81-87, 6 *figs.*

THE PROBLEM OF automatic longitudinal stabilizers for airplanes having been sufficiently covered in previous issues of the magazine, the author confines the present article to the study of automatic lateral stabilization. He gives a mathematical analysis of the laterally disturbed motion of an airplane, indicating that this is more complicated than the longitudinal, and examines the derivatives of the forces and aerodynamic couples with respect to the linear and angular speeds. He shows that the relative importance to give to the rudder movement and lateral inclination depends on the aerodynamic characteristics of the wing, concluding with an explanation of the effect of flying at increased lateral incidence. Various arrangements for obtaining lateral stability, justified by the principles covered here, will be described in subsequent issues.

Seaplane Stability

Static Stability Tests of Six Full-Scale Twin Float Seaplanes, R. K. Cushing, A. S. Crouch, and R. W. Angell. (British) Aeronautical Research Committee—Reports and Memoranda No. 1653, *August* 23, 1934 *(published October* 9, 1935), 20 *pp.,* 13 *figs. on suplementary sheets.*

THE EXPERIMENTS described were undertaken to determine the longitudinal and lateral metacentric heights and the capsizing moments of a number of twin-float seaplanes. It was found that the moment required to capsize the seaplanes when trimmed aft was somewhat smaller than the requirements of the Air Ministry specifications. The experimental results indicated that these heights could be calculated with a good degree of accuracy if the water line is known accurately.



General layout of the "Pou-de-Ciel"

Wing Flaps

Wing Brake Flaps, W. Pleines. Aircraft Engineering, Vol. 7, *No.* 79, *September,* 1935, *pp.* 213-219, 21 *figs. Bibliography.*

METHODS OF operation and the efficiency of various types of flaps for airplane wings are discussed and the results of wind-tunnel and full-scale experiments undertaken in various countries, compared. The effect of flaps on the flying characteristics of the airplane is taken up, such as the movement of the center of pressure and pitching moments, and the behavior of the plane near maximum lift, especially beyond the stall.

Wind-Tunnel Interference

The Wall Interference of Wind Tunnels with Boundaries of Circular Arcs, K. Kondo. Tokio Imperial University—Aeronautical Research Institute, No. 126, *Vol.* 10, *No.* 8, *August,* 1935, *pp.* 197-262, 18 *figs.*

WIND-TUNNEL WALL interference is investigated theoretically for several cross sections of wall of practical importance which are bounded by circular arcs and may be expressed by bipolar coordinates. The interference factor of Prandtl's correction is calculated for each case. Illustrations of Glauert's theorem on interference are given for wind tunnels bounded by two equal and opposite circular arcs of free surface and rigid wall, respectively, and for circular and arch-shaped semi-closed tunnels.

Tandem-Wing Airplanes

Tandem-Wing Aeroplanes, J. H. Crowe. Aircraft Engineering, Vol. 7, *No.* 80, *October,* 1935, *pp.* 243-248, 6 *figs.*

CHARACTERISTICS OF the tandem-wing airplane and, in particular, H. Mignet's *Pou-de-Ciel* are discussed. The lower wing is set at approximately one-fifth to one-quarter chord below the upper and overlaps it by about one-eighth chord. The span of the upper wing is 19.7 ft., the lower wing span 13.2 ft., and the chords of both wings 4.6 ft. The system of longitudinal control involves hinging the front spar of the upper wing to the supporting structure, giving a variable degree of decalage. There is complete suppression of the ailerons, the whole of the lateral and directional control devolving on the rudder.

The author discusses the efficiency, effect of stagger, relative loadings, slot effect of the two wings, landing qualities, trim, stability, rate of climb and spinning problems of the plane. He believes that the condition for stability effectually precludes the possibility of obtaining any considerable slot effect on the front wing and of thus reaching high values of maximum lift coefficient, but in other respects, the system of longitudinal control is an advantage.

EQUIPMENT and METHODS

Caterpillar Tractors

• CATERPILLAR TRACTOR Co., Peoria, Ill., has developed four new Diesel tractors, to be known as the RD-8, RD-7, RD-6 and RD-4 and a spark ignition machine called the Thirty.

The first three Diesel models succeed the Diesel Seventy-Five, Diesel Fifty and Diesel Forty and are comparable with them in everything except power. Engines in these three achieve more power through an increase in cylinder bore from 5-¼ to 5-¾ in., and other refinements that have been made in the engine and fuel injection system.

Drawbar and belt horsepower respectively of the new models are as follows: Model RD-8, 95 and 110; Model RD-7, 61 and 70; Model RD-6, 45 and 51; Model RD-4, 35 and 41; and Model Thirty, 35 and 41.

Studies of present field requirements with their demand for added power have resulted in the RD line, which tests show, has increased production and decreased net costs in construction and earth-moving tasks. Except for addition of the new Thirty, there is no change in the company's line of gasoline tractors. Present models are the Twenty-Two, Twenty-Eight, Forty, Fifty and Seventy tractors.

Non-Magnetic Headphones

• TYPE A headphones developed by the Brush Development Co., Cleveland, Ohio, feature a non-magnetic operation that permits their use in planes and crowded quarters close to other sensitive instruments that might be affected adversely by the proximity of a magnetic field. Drivers in these new phones are piezo electric crystal elements, a construction which gives a response from any normal source. These phones handle excessive volume without overloading; there are no magnets to cause diaphragm chatter and greater volume is secured from weak signals. Specially designed cases and the use of self-tapping screws tends to reduce breakage.

Gould Glassklad Batteries

• WITH THE introduction of the Kathanode "Glassklad" Type KMD motive power cells, the Gould Storage Battery Corp. is offering an improvement over its previous batteries. Positive base castings have been made thicker and heavier, the volume of active material has been proportionately increased and processing methods have been improved. High current demands for starting, for operation on ramps and for excess loading, is secured from the black oxide active material which also has the characteristics of greater sustained capacity.

Each positive "Glassklad" unit makes use of scientifically proportioned laminated mats of finely spun glass to retain the active material in the base structure. These mats are highly porous, strong and flexible. They become so intimately associated with the faces of the active material that there is no shedding except for the small amount of spent peroxide which gradually works its way, longitudinally downward, to the sediment chamber. A feature is the porous structure of the mats making possible large volumes of electrolyte immediately adjacent to the active material.

The sediment space has been decreased to 1¼ in. eliminating excessive rib height. The element has also been dropped in the jar to provide a larger electrolyte chamber at the top of the cell and to include a greater distance from the top edges of the plates to the underside of the crossbar, resulting in increased insulating space.

Armored Glassklad Kathanode cell

While the Armored envelope of perforated hard rubber has been retained with its original features of solid sections surrounding the outside vertical edges and round perforations, the porosity has been increased. Other cell improvements embrace large vent plugs, easy to remove and replace. These plugs have baffles and are so vented that the electrolyte cannot spray over the top of the cell. The completely cushioned element is retained with a triple seal to the posts and cover. Jars are of a high tensile strength relatively flexible genuine hard rubber, as are also the covers.

Portable Test Units

• SUITABLE FOR general testing, laboratory and radio work, a line of compact light-weight portable volt-ohmmeters and test units has just been announced by Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Equipped with a new type d'Arsonval movement and selector switches for range selection, the units simplify testing of circuit resistance, continuity and insulation. The volt-ohmmeter is probably the most useful tool for exploration and trouble shooting in complex circuits such as radios, public speech amplifiers, signal systems, and other applications where detailed knowledge of circuit conditions and values must be obtained.

Several types are available including simple ohmmeters, volt-ohmmeters, d-c. test units and the more elaborate multi scale a-c.-d-c. test units. The instruments weigh approximately 2 lbs., have a 2.4-in. scale length, an accuracy within 2% for d-c. volts and milliamperes and within 5% for a-c., and are mounted in a 7 in. × 4 in. × 3-¼ in. Moldarta case.

Recessed Head Self-centering Screws

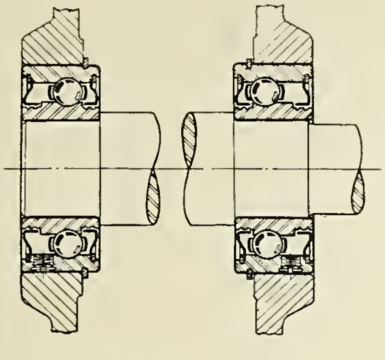
• A LINE of screws and bolts with a newly designed, recessed head has been developed by the American Screw Co., Providence, R. I.

In the Phillips head a tapered recess which exactly fits a tapered driver takes the place of the slot in the ordinary screw. The screw holds on the point of the driver and may be moved into position for driving with one hand. There is no danger of the driver slipping and no pilot holes are required in driving the screws, unless it is necessary to remove enough wood to prevent splitting.

Davis Kit For First-Aid

• A NEW first-aid kit, known as the Brac-Kit has been developed by the Davis Emergency Equipment Co., New York. It can be permanently installed in a given place, but its contents are instantly available in emergencies and are protected from contamination and damage when treatment is being applied.

The kit consists of two baked enamel steel cases, an outer case which can be screwed into a wall, and an inner case which is normally kept inside the outer, where it is held in place by a lock. When needed, the inner case can be unlocked by a twist of the handle and carried, with all necessary first-aid supplies, to the scene of the accident.



Cartridge Type Precision Bearing

• NORMA-HOFFMANN Bearings Corp., Stamford, Conn., has added to its line of self-protected precision bearings, a completely enclosed cartridge type single-row unit designated as the "3000" Series.

This series, although having but one row of balls, has inner and outer rings of standard double-row width. The bearing is completely enclosed, and protected on both sides by metal seals held in place by snap-rings on the outer race. These seals have a long inwardly projecting flange with a close running fit over the grooved and recessed inner ring. The latter arrangement, while free from rubbing friction and wear, forms an effective and permanent seal against the escape of lubricant. The metal sealing plates are easily removable for inspecting or cleaning the bearing.

The wide inner and outer rings give two advantages. First, exceptionally large grease capacity is afforded, sufficient for long periods of continuous operation under average operating conditions. Second, looseness or peening of either shaft or housing is obviated by the greater contact area the wide rings provide.

The 3000 precision bearing is made chiefly in the medium series starting at 25 m/m bore.

Hydraulic Press

• THE #60 self-contained Hydraulic Press with pressure controls from ½ to 15 tons on the down stroke and from ½ to 13 tons on the up stroke, has been announced by the Greenerd Arbor Press Co., Nashua, N. H.

The pump is driven by a 3 h.p. motor mounted on the side of the frame with the tank at the rear of the press. The control valve is either foot or hand operated, and automatic or manual reverse can be made at any point in either direction. A stop rod also regulates the length of travel in either direction. When the ram is at top position the pump bypasses, relieving all pressure.

The #60 is adaptable for assembly work, push or pull broaching, keyway cutting, and light plastic molding. Adjustments may be quickly made to control the desired pressure most suitable for work up to 15 tons.

High Pressure Lubricator

• THE BALCRANK AC-30 high pressure hand gun weighing less than 28 lbs., with a capacity of 30 lbs. of lubricant, develops 6,000 lbs. pressure.

Tests show the delivery of a large volume of lubricant, under all conditions, at high pressures, and the development of high pressure with heavy lubricants. Fluid type lubricant is delivered at the rate of 8 oz./min. decreasing as the density of the lubricant increases. The charging chamber holds 4 times the amount of lubricant that can be handled in high pressure chambers, assuring adequate supply of lubricant.

Because of its dimensions, the AC-30 can be operated in confined quarters. Its standard equipment consists of 3-way swivel joint, pin-type connector, new style hydraulic chuck, and 7 ft. of high pressure grease hose.

Balcrank high-pressure lubricator

Cincinnati Ball Crank Co. are the manufacturers of this unit.

Windshield Cleaner

• A NEW development by the Gem Shine Products Co., Chicago, is a cleaner for airplane windshields and windows. Called *Cel-U-Clear,* the product will thoroughly clean plastacele, pyralin, celluloid, and other similar materials. The use of the *Cel-U-Clear* solution will restore the flexibility of the windows, smoothe over cracks, prevent further cracking or checking and discoloration of the window material. *Cel-U-Clear* is designed to prevent discoloration, scratching and cracking of cellulose units and to clean and preserve such materials.

Public Address System Control

• SPECIALLY DESIGNED for public address systems and portable equipment, a new attennator has been produced by Tech Laboratories, Jersey City, N. J. Featuring wide range, the unit has 22 steps of attennation covering a range of 50 decibels. It measures 2.125 in. in diameter by 1.812 in. deep. Besides sound recording, public address, and broadcasting application, it is adaptable in the laboratory in experiments requiring low dc or ac voltages.

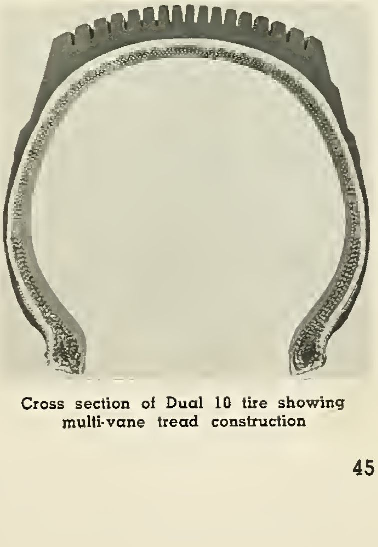
Multi-Vane Rubber Tire

• A NEW type of tire, said to be built on an entirely new principle in tire construction, has been demonstrated by the General Tire and Rubber Co. By taking pictures and by actual demonstration, it was shown that this tire, known as the Dual 10, will stop a car, straight in its tracks, on a wet pavement. The tire design also is being developed for aircraft use, but its immediate production in this field has not yet been announced.

In contrast to conventional tread designs the tread of this tire is made up of many thin rubber flutes or vanes running longitudinally around the tire.

When brakes are applied hard, in an emergency stop, photographs through plate glass revealed that these thin rubber vanes form a serpentine pattern on the surface, each rubber vane acting as a squeegee to wipe the moisture off a wet surface so the adjacent vanes can cling to a substantially dry surface. This same squirming, squeegee action of the multi-vane tread forms a clinging non-skid tire surface on a dry pavement.

Photographs also revealed that some of the conventional tire tread designs closed up, under braking pressure, to form a smooth, slippery tire surface, susceptible to skidding.



Cross section of Dual 10 tire showing multi-vane tread construction

The "Explorer II" Stratosphere Balloon

● When Captains Albert W. Stevens and Orvil Anderson ascended to a height of 72,395 feet on Nov. 11, they not only set a new world's record for altitude, but also brought back immensely valuable scientific data from which many problems are expected to be solved.

Flying in the *Explorer II* the men used the largest balloon of its type ever made. To carry out the expedition with its many objectives, the sponsors of the flight, the National Geographic Society and the U. S. Army Air Corps, obtained from the Goodyear Zeppelin Corp., a balloon which when fully inflated had a diameter of 192 ft. The bag of the balloon was constructed by the Goodyear company from fabrics secured chiefly from Wellington Sears Co. In their construction they used three fabrics—BA-30, BB and HH, each distributed according to calculation of stresses to be met. The characteristics of these fabrics are shown in Table I.

Table I

Fabric	Threads (sq. in.)	Weight per sq. yd. (oz.)	Breaking Strength lbs./sq. in.
BA-30	80 × 80	4	80
BB	104 × 104	3	60
HH	130 × 138	2	40

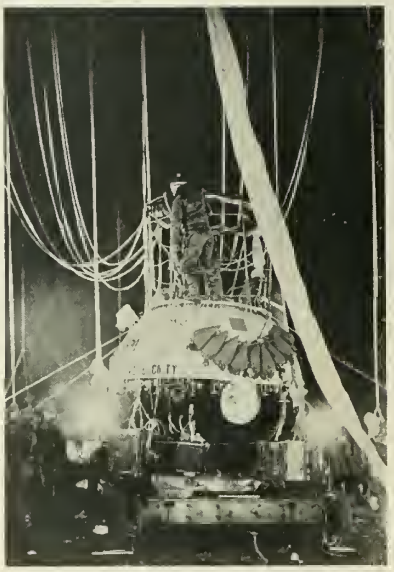
Only 230,000 cu. ft. of helium was valved into the bag for the take-off to allow for an expansion to more than ten times this volume. Made of cotton cloth with a special rubber dressing, the balloon and its network of cables weighed 6,350 lbs. The gondola, instruments and equipment and the pilots weighed 3,750 lbs. More than 6,500 lbs. of lead shot ballast was hung in bags outside the gondola and another 1,500 lbs. was on the inside, giving a total weight of about 9 tons.

For inflation the balloon was held to the earth by anchors in concrete beds from which 36 cables stretched to a heavy band of canvas near the top. Below that was a second band with the lower portion cut into 160 catenaries to which the ropes holding the gondola were attached.

Starting at the balloon there were 160 of these ropes, joined into spiders, or bridles, to form first eight and then forty lines, the ends of which connect with the upper load ring of the gondola, also fashioned of rope.

Six feet below was the gondola itself, attached by its lead ring to the ropes above by ten strips of strong flat linen webbing, fenced with a series of cords as a safety measure.

The gondola was a cylindrical globe, nine feet in diameter, made from dowmetal. It had two elliptical manholes, six observation portholes, one of them covered with a fused quartz lens. The white enamel interior wall was lined with instruments, dials, various meters and manifold control switches for the instruments.


Acme Photo

Preparing for the ascent

Extending up and out from its hinge near the base of the gondola was a light metal arm at the end of which an electric motor turned an 18-inch propeller, which for a time kept the airship and the suspended gondola turning in order to make observations from all compass directions and all angles.

High on the side of the sphere was an 80-foot parachute designed by Lieut. Col. E. L. Hoffman, who also supervised the making of the parachutes which the pilots used to lower their batteries and instruments as they descended.

Recent Patents

●

The following patents of interest to readers of Aero Digest recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Retractable landing-gear. Frank R. Canney, Seattle, Wash., assignor to Boeing Airplane Co. (2,015,920)

Aircraft armament. Ignacio J. Miranda, New York, N. Y., assignor to American Armament Corp. (2,016,211)

Self-steering arrangement. Eduard Fischel, Berlin-Charlottenburg, Germany. (2,016,857)

Beacon. John B. Bartow, Blue Bell, Pa., assignor to Bartow Beacons, Inc. (2,017,052).

Apparatus for collecting air mail and express. Harry P. Trusty, Los Angeles, Calif. (2,017,081)

Aircraft having sustaining rotors. Joseph S. Pecker, Philadelphia, and Agnew E. Larsen, Huntingdon Valley, Pa., assignors to Autogiro Co. (2,017,105)

Strut fairing bracket. Charles E. Hathorn, Hempstead, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,017,207)

Wind T for airports. Arthur M. Wilhelm, Randolph, N. Y. (2,017,224)

Aircraft and three-point landing gear for same. Igor Sikorsky, College Point, N. Y., assignor to United Aircraft Corp. (2,017,446)

Propeller blade mounting for variable-pitch propellers. Howard C. Meon, Cleveland, Ohio, assignor to Meon Engineering Corp., New York, N. Y. (2,017,505)

Flying machine. Spencer Gray, Seattle, Wash. (2,017,692)

Combination magnetic compass and level indicator. Edwin J. Grant, Los Angeles, Calif. (2,017,900)

Aircraft wheel brake. Frederick J. Tarris, London, England, assignor to India Rubber, Gutta Percha & Telegraph Works Co., Ltd. (2,017,928)

Aircraft. Constantine L. Zakhartchenko, Beechhurst, N. Y., assignor to Zee Aircraft Corp. (2,018,001)

Spinner cowl. Roland Chilton, Ridgewood, N. J., assignor to Reed Propeller Co., Garden City, N. Y. (2,018,012)

Airplane construction. Michial and Daniel Aslanian, Los Angeles, Calif. (2,018,109)

Navigational guide system. John H. Hammond, Jr., Gloucester, Mass., assignor to Radio Corp. of America. (2,018,357)

Aircraft. John Juergens, Chicago, Ill. (2,018,448)

Aileron control. Virginius E. Clark, Baltimore, Md., assignor to North American Aviation, Inc. (2,018,546)

Aircraft. Paul M. Lewis and Fred Landgraf, Denver, Colo., assignors to Lewis-American Airways, Inc. (2,018,730)

Aircraft. Severyn L. Molicki, Denver, Colo. (2,018,734 and 2,020,616)

Gyrovertical. Frederick G. Narvesen, East Rockaway, and Mortimer F. Bates, Brooklyn, N. Y., assignors to Sperry Gyroscope Co. (2,018,735)

Sound-propagating apparatus (in an airplane body). Emmett Pelegatti, Garfield Heights, Ohio. (2,018,740)

Airplane. Nicholaus Franzen, Chicago, Ill. (2,018,889)

Aircraft. Wilbur E. Methvin, Lawrenceburg, Tenn. (2,019,018)

AIRLINES AND AIR TRAVEL

Seven Pilots Get Medals

MEDALS FOR heroism while flying the mail were awarded to seven pilots by President Roosevelt during ceremonies at the White House.

Recipients of the awards were Grover Tyler and Roy H. Warner of United Air Lines; Wellington P. McFail, American Airlines; Edward A. Belland, TWA; Gordon S. Darnell, Braniff Airways; Louis S. Turner, Bowen Airlines; and James H. Carmichael, Jr., Central Airlines.

September Traffic Holds Gains

SCHEDULED AIR transportation in the United States during September was marked by a seasonable decrease, but the 77,370 passengers carried was considerably in excess of 1934 figures when 45,248 passengers flew. The total number carried in August, 1935 was 89,581 the peak of American airline traffic for all time. Passengers carried during the first nine months of the year were 635,190 or more than the entire total last year.

There were increases in the amount of express carried and the express miles flown in September as compared with the preceding month. Express totaled 417,223 pounds and 229,094,152 express pound miles were flown.

Passenger miles were 32,023,693 and miles flown were 5,360,092.

Reflection of this tremendous traffic is seen in United Air Lines reports for the first nine months of the year. Increases of 24 percent in passenger traffic, 52 percent in express, and 85 percent in air mail were reported for that period as compared with the first three quarters of 1934.

Carrying 140,160 revenue passengers, United showed an increase of 26,866 passengers over the total of 113,294 passengers in the same period of 1934. United transported an aggregate of 1,182,229 pounds of air express in the nine-month period, an increase of 403,072 pounds over the total of 779,157 pounds in the corresponding three quarters of the previous year.

Air mail on United between January 1 and September 30 totaled 3,718,097 pounds, an increase of 1,675,048 pounds over the 2,043,049 pounds transported in the corresponding period last year. It was pointed out, however, that the 1934 figure was proportionately smaller as the company did not carry mail for almost three months during 1934 due to air mail contract cancellations.

American Airlines carried 153,056 revenue passengers during the first ten months of the year, a gain of 80.16 percent over the same period a year ago. In this period the company consistently carried more passengers monthly than in any comparable month of its history, even extending this record an additional two months, making 14 consecutive months in all.

Airlines Purchase Equipment

NEW TWO-WAY radio equipment is now being installed by Chicago and Southern Air Lines over its entire system from Chicago to New Orleans. The development program represents an investment of approximately $18,000 and calls for radio transmitter and receiving equipment in Chicago, St. Louis, Memphis, Jackson and New Orleans.

The installations require the construction of a new radio building with the necessary accessories, in St. Louis and in Memphis. The radio units will be installed in the Northwest Airlines' hangar in Chicago; and in Jackson the company's transmitter and receiver will be located in the administration building at the municipal airport. In New Orleans the equipment will be installed in the Eastern Airlines' hangar.

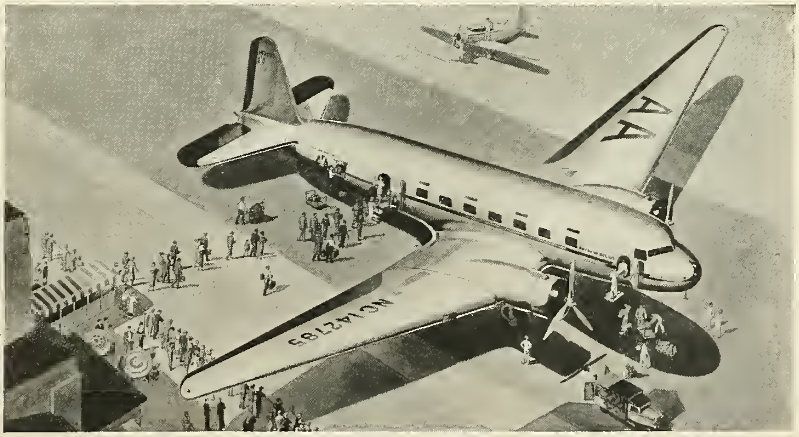
Northwest Airlines is installing new mechanical de-icing equipment on all planes operating over their route between Chicago, Twin Cities and Seattle as a further effort at completion of schedules during the winter season. Installation of this equipment will entail an expenditure of approximately $13,000.

In preparation for winter flying operations United has installed improved type de-icers on thirty of its 247-D transports and expects to show even more effective results from their use this winter over the experience with the de-icers in the 1934-35 season. A feature of the new de-icer is the method of installation on the wing, which provides for affixing the rubber over-shoes to the wings by special clamps.

Announcement by American Airlines, Inc., of an order for a fleet of 10 new-type Douglas planes climaxes a $4,500,000 re-equipment program instituted by the company over a period of two years, according to C. R. Smith, president. The new order calls for ten Douglas DST transport planes, the total involved exceeding $1,700,000 including spare engines and parts.

The planes will be convertible sleeper planes, built to carry 24 passengers and a crew of three as day planes or 16 passengers and crew as sleepers. Each plane will have a gross weight of 12 tons and, fully loaded, will have a cruising range of 1,400 miles, and a maximum speed of 215 m.p.h. Orders for new equipment scheduled for delivery to American Airlines within the next six months exceed $2,260,000 and include, in addition to the Douglas sleepers, 15 new Stinson model "A" tri-motored transports.

A complete two-way radio communications system covering the lines of Boston-Maine—Central Vermont Airways in Northern New England is to be established immediately and is expected to be in complete operation by January 1. Installation of ground stations, equipped for two-way communication will commence at once at Boston; Bangor, Me., and at Burlington, Vt. These will be followed by others at Montpelier, and White River Jct., Vt.; Concord and Manchester, N. H.; and at Portland, Waterville and Augusta in Maine. Floyd E. Grey, formerly of Eastern Airlines, has been engaged as chief communication engineer to direct the development and installation of the system.



Artist's conception of the new 24-passenger Douglas DST transport plane

THE AIR SERVICES

New Course At Technical School

UNDER AUTHORITY of the War Department, and under supervision of the Commandant, Col. Junius W. Jones, there will be incorporated into the Air Corps Technical School at Chanute Field, a new course to be presented under the name of Basic Instruction.

There has been a long felt need for such a course, which materialized with the school year 1935-36. Its object is to provide a uniform system of basic preparation for all enlisted students entered in the school in order to fit them better for technical specialization in various main courses.

The department is being organized under the immediate direction of Capt. James S. Stowell who has been assigned as director. Instructional personnel and equipment is being drawn from other departments of the school where various subjects of basic instruction have been taught. One hangar is being remodeled to suit the needs of the department for shops and classrooms and it is expected that the department will receive its first class at the beginning of the school year, consisting of approximately 60 students.

The curriculum of the basic course will include, for its first year, about eight weeks, according to the needs of the individual specialization departments of the school, with the subjects in mathematics, drafting, elementary metal work, electricity and woodwork.

The addition of this department to the Technical School, together with the department of clerical instruction, which was established in 1933, brings the total departments of the school to six, including the earlier established departments of Mechanics, Photography, Communications and Armament.

Selfridge Field Maintenance Projects

AN ALLOTMENT of $79,000 was recently received by the Post Quartermaster, Selfridge Field, Mich., for repair and maintenance projects. Plans include $39,000 for extension of the heating and electrical system, including new submarine primary cable to replace the overhead lines, a new primary house and simplification of the present system; and $14,000 for the maintenance of buildings, grounds and utilities, including interior and exterior painting of quarters and barracks, modification of the officers' mess and bachelor officers' garages, improvement of grounds and repair of roads. Allowance for the purchase of material and labor from relief rolls is included in each project.

New Class At Randolph Field

THE NEW class of students which reported recently at the Primary Flying School, Randolph Field, Texas, has already begun flying training. This class is composed of 48 officers of the last West Point class, six additional Army officers, 91 flying cadets and three foreign officers, these latter being 1st Lieut. Mariano P. Munoz, Mexican Army, and 3rd Lieutenants Jose Francisco and Vincente B. Luna of the Philippine Constabulary.

A few days before the new class started training, a class of fifty-eight students was graduated and sent to the Advanced Flying School at Kelly Field. This class was composed of six Regular Army officers, two foreign officers, and 50 flying cadets. The foreign officers were Capt. Jose C. Muricy, Brazilian Army, and 1st Lt. Jose G. V. Ahumada, Mexican Army.

Instrument Flying Tests Completed

ALL PILOTS of the 41st Division Aviation, Washington National Guard, Felts Field, Spokane, Wash., have qualified in instrument flying and were issued their certificates by Major Robin A. Day, commanding officer and instructor.

Each check flight started with the pilot taking off under the hood and then going into level flight at an altitude fixed by the test pilot, who used the interphones. Probably the greatest difficulty encountered by the pilots was in the proper execution of the 90° and 180° turns, the tendency being to tighten the turns. A similar experience was witnessed in the fast turns. All phases of instrument flying were covered, including spiral climb, glides, stalls and recovery from spirals and spins. Orientation proved to be the most difficult problem in the employment of the radio range beacon.

88th Observation Squadron Moves

TRANSFER OF the 88th Observation Squadron, U.S. Army Air Corps from Brooks Field, San Antonio, to its new station at Hamilton Field, San Rafael, Calif., has been completed. A flight of six planes, led by Capt. Robert H. Kelly, departed from Brooks Field via El Paso, Tucson and March Field.

The squadron, under the command of Maj. C. E. Giffin, is a part of the 1st Wing, GHQ Air Force, at March Field, Calif., under the command of Brigadier General Henry H. Arnold. This squadron, upon its arrival at Hamilton Field, was equipped with long range amphibion planes required in distance reconnaissance work, much of which will be performed on water.

The move completes the reorganization of the Air Corps and solidifies the various wings of the GHQ Air Force.

GHQ Air Force Douglas Transport

A NEW Douglas transport fitted as a headquarters airplane for use of the staff of the General Headquarters Air Force is now in service. Designed to serve as a flying office in which the staff officers could be moved as a unit, with facilities for carrying on work while in flight or at rest on the ground in whatever location feasible, the airplane, which is the standard commercial type, presents a shipshape interior.

Immediately to the rear of the pilot's cockpit is a radio room with transmitting and receiving sets. A locker compartment for maps, dispatches or data is alongside. The commanding general's office is immediately aft of the radio room with a connecting window. This office contains a desk and two chairs, and is used for conferences with staff or other officers during emergency flights or maneuvers.

To the rear of the office and occupying the central section of the fuselage are four chairs with desks on either side of the center aisle. Desks are arranged to hold all types of stationery and writing equipment, and have extensions for the study of maps and large drawings. Furniture is of walnut.

The U. S. Navy P. & W.-powered Consolidated flying boat XP3Y-1, which recently set two world's records for seaplanes

SBU-1

LATEST SCOUT BOMBER *by* CHANCE VOUGHT

Newest addition to the distinguished line of Vought airplanes already in service with the Navy is the SBU-1. Designed for operation from aircraft carriers, and combining the functions of long range scouting and bombing, the SBU-1 adds new performance standards to the traditional dependability of Vought Corsairs in Naval service. Characteristic of its advanced design is the efficient power-plant combination of geared Twin Wasp Junior engine, Hamilton-Standard controllable propeller, and United's latest development, the flapped" engine cowl.

CHANCE VOUGHT AIRCRAFT

DIVISION OF UNITED AIRCRAFT MANUFACTURING CORPORATION, EAST HARTFORD, CONNECTICUT

E. E. Wilson, General Manager C. J. McCarthy, Eng. Manager

ACTIVITIES AT THE SCHOOLS

Student Activities

COOPERATING WITH the city of Newark during Air Progress week in the opening of the new Administration Building at the Newark Airport, the Casey Jones School of Aeronautics exhibited three Cyclone engines, welding apparatus, propellers and airplane parts. A group of students demonstrated engine overhauling and also acted as guides, explaining to the public the things of interest in the various airliners.

The practice of allowing students to follow through on their own original designs during their course in Aeronautical Engineering has recently been inaugurated at the Curtiss-Wright Technical Institute of Aeronautics. Permission is granted the student to work on his own design rather than the regular school design project with the understanding that he will probably run over the allotted time of the course in completing his work and meeting the standards of the Institute.

The Aero Club of Parks Air College secured a club-room when a portion of *Skyway Inn*, located on Curtiss-Steinberg Airport, was loaned to it through the courtesy of Major Wassel, airport manager.

The first meeting held in the new quarters brought out the best attendance to date. R. C. Schmidt, chief of the U. S. Weather Bureau at Lambert Field, was the speaker.

New Courses Available

TWO CHICAGO classes in practical aviation recently started sessions under auspices of the emergency educational program. For daytime students there is a class at Tilden Technical high school, and the evening class meets in the school rooms of the Hyde Park Baptist church.

The courses start with a brief outline of the history of aviation and continues through the stages of development up to the present. Theory of flight, elementary aerodynamics, airplane design and construction, maintenance and power plants and instruments and accessories are taught.

A new mechanics school has been opened by Captain Sansom who has conducted a flying school at Brainard Field, Hartford, Conn., for several years. This is in addition to the flying school.

Boeing Scholarships Again Offered

FOUR COMPLETE courses at the Boeing School of Aeronautics, Oakland, Calif., having a total tuition value of $10,400 have been announced as the awards for the Seventh Annual W. E. Boeing Scholarships.

The first award is an airline pilot and operations course worth $5800. The second, third and fourth place winners have a choice of one of the following combination courses: airline operations and amateur pilot; airline technician and amateur pilot; airline traffic and amateur pilot; airline mechanic and amateur pilot.

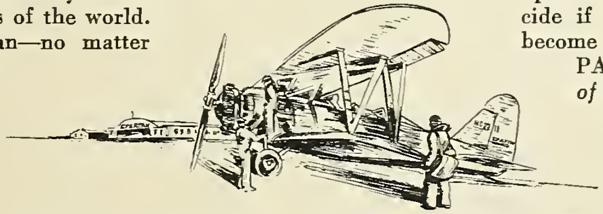
Eligible candidates are male undergraduate students at some American or Canadian college, university, or junior college which offers at least two years of work leading to a Bachelor's Degree in Arts or Sciences. The awards will be based on technical or non-technical treatises of not more than 3500 words on some aeronautical subject.

Entries close March 15, 1936 after which a committee consisting of Dr. Baldwin M. Woods, W. B. Stout, Prof. K. D. Wood and Prof. Montgomery Knight will judge the papers for the scholarship awards on the basis of completeness and soundness of the subject matter, its originality, and choice; and the analyzation and conclusions drawn in the paper.

The student body and faculty of the Casey Jones School of Aeronautics. At the top, day class; below it, the night class

6 o'clock Patrol

The first rays of dawn are breaking across the eastern sky, standing on the parapet comes the even roar of engines warming up, behind you stretch the hangars and school buildings—*you're at Spartan,* a full-fledged member of the Dawn Patrol. Today you start your first actual flight instruction, with dozens of other boys from all sections of the country—from the four corners of the world. Here at Spartan—no matter in which of the 3 STAR * * * Courses you have enrolled, you will have as your instructors, specialists in every branch of aeronautics. The school is completely equipped and is one of the highest rated flying schools in the country. Your future is worth too much to jeopardize with less than the best. Investigate SPARTAN, study the new catalog, see what Spartan has to offer you—then decide if YOU too do not want to become a member of the DAWN PATROL—*the training school of the successful in Aviation.*



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AT THE AIRPORTS

●

New Airports

APPROXIMATELY 5,000 persons witnessed the official dedication of the new Merrill, Wisc., airport, sponsored by the Edward Burns post, American Legion, with Edward B. Mulick in general charge of the flying troupe which participated.

The City of Joplin, Mo., purchased 319 acres for a municipal airport and work is already progressing on the runways, which will be hard-surfaced. Other projects pending government approval include building hangars and an administration building and installing lighting equipment.

Fifty business men of Tupelo, Miss., have joined in an endeavor to give their city a municipal airport. They have underwritten a city note to assure the city of a $62,000 WPA allotment for construction of the field.

Representing eight months of effort on the part of the Macon, Ga., Chamber of Commerce, the city obtained title to 260 acres of land, located approximately five miles from the city for a new airport. Work on the project has already begun. There is an allocation of $250,000 for developing the airport.

Each of the four runways will be one thousand ft. wide. Their length will be 3800, 4250 and 4600 ft. The hangars will be constructed of steel and will be of latest design. An administration building costing about $15,000 will be modernistic from every standpoint.

Airport Improvements

IMPROVEMENTS AMOUNTING to approximately $400,000, including completion of the hard-surfaced runways and erection of a modern administration building will be sought for Love Field, Dallas, by the newly-formed Aviation Board of the city, it has been indicated. Booth and Henning, Inc., who have the distributorship for Stinson and other aircraft for Texas are constructing a new brick and steel hangar and general office that will cost more than $60,000 when completed. This new building will be one of the most modern and complete hangars on the field.

Agitation for removal of electric wires near airports has resulted in an order by the aviation committee of the Chicago city council to remove all overhead tension wires from the vicinity of the municipal airport.

Work has started on the construction of a blind landing approach system at the Lambert-St. Louis Municipal Airport, St. Louis, Mo. Equipment and materials were purchased by the city and labor will be paid for out of a WPA allotment.

The Bureau of Air Commerce has approved two new projects at Lambert Field as technically and financially sound and these now await WPA approval before an allotment can be made. One project is the installation of a 25,000-gallon underground fuel tank for 35th Division Aviation, National Guard, and the other project is construction of roadways, culverts and a parking area.

Improvements to the municipal airport at Montgomery, Ala., costing approximately $102,000 are scheduled to be made. The work will consist of remodeling and improving the club house, new aprons and runways.

A new lounge for students, besides other interior refurnishings, has been placed in the Inter City Airlines hangar at the Boston Municipal Airport.

WPA Allotments

OUT OF $1,500,000 WPA funds which Nebraska authorities expect to be forthcoming during the coming year for improvement of airports within the state, $302,255 has been definitely assigned by WPA authorities for constructing the Grand Island municipal airport. The project, already approved by the Department of Commerce, will include construction of four hard-surfaced runways, a hangar and an administration building.

The city of Omaha has made application for a grant of $587,515 for municipal airport improvements, including new buildings, runways, lighting system, and drainage.

The Nebraska WPA reveals that Lincoln has requested $70,824 for airport improvement, while Norfolk requests $80,750 and in addition has $17,460 pledged in sponsor's funds. Other Nebraska sites where extensive airport improvements are planned with WPA funds include Hastings, Alliance, North Platte, O'Neill, Valentine, Columbus, Wayne, Scottsbluff and Ainsworth.

Allocations of $104,387 to the Salt Lake City municipal Airport, and $3,982 to the Carbon county airport at Price, were included among the first in Utah. Other flying fields are to be improved, and already many Utah towns and cities have filed applications for airport improvements, according to J. E. Garn, local regional airport supervisor.

Some of the cities expected to qualify under the program are Richfield, Kanab, Delta, St. George, Provo, Ogden, Brigham City, Logan, Vernal, Roosevelt, Myton, Duchesne, Moab, Fillmore and Nephi. Landing fields have been suggested between Mt. Pleasant and Fairview, Manti and Ephraim, and a number of other places in the state.

Supply House Moves

THE AVIATION Supply Division of the Montgomery School of Aeronautics has been moved to the Atlanta municipal airport at Hopeville. Coincident with the move, the operating name has been changed and in the future, the wholesale and retail aviation supply business will be known as the Aviation Supply Co.

The school will continue to operate a branch store at the Montgomery, Ala. port in connection with its school and service station activities but the main supply house will be maintained at Hopeville.

Larger inventories will be carried, and a more varied line of merchandise will be stocked. Eugene H. White will be in charge of the new store at the Hopeville Airport.

Special Equipment Installed

AIRCRAFT INDUSTRIES has added the Magnaflux inspection method equipment to the facilities of their aircraft engine repair station at Grand Central Air Terminal, Glendale, Calif. In aircraft work this inspection method is used to locate cracks in crankshafts. The metal part to be inspected is magnetized and placed in a liquid containing an iron oxide power. Cracks in the metal change the magnetic field and the iron oxide is drawn to the center of this field which is along the cracks. Thus the cracks are exposed. The installation of the equipment in Aircraft Industries' engine repair station is one of the first installations in a commercial aircraft engine shop. The method has only recently been adopted by some of the government stations and engine manufacturers.

Personnel Changes

WITH THE resignation of Ben Lichty as president of the Lambert-St. Louis Airport Association, St. Louis, Mo., J. T. Verlin, former vice-president, became the head of the association. The by-laws were amended to provide for the secretary-treasurer, A. W. League, to preside in the absence of the president.

Culver Airport Corp. has employed H. L. Kindred as its general manager at Love Field, Dallas. The company is Texas distributor for Wacos, and occupies the United Air Lines hangar there.

Ora Liming has taken charge of the Raven Rock airport, Portsmouth, Ohio. He succeeds Sylvan Jackson.

J. E. Garn, former district engineer for the Utah road commission, has been appointed regional supervisor, airways construction by the federal government. He will have charge of local airport improvement programs under the works progress administration.

Speed is NOT

the first essential in

airplane transportation.

The SUREST plane often

takes a few minutes

more per trip.

Smoke
SIWO
"AN' YESTERDAY HE WON A BET FROM UNCLE HERMAN FOR MAKIN' A BARBER POLE OUTA THAT SMOKESTACK."

The gentleman in the above picture never flew in the Lafayette Escadrille or made Richtofen green with envy. But we happen to know that this fellow goes over his ship from stem to stern long before the usual 300 flying hours are up. No weakness escapes his eagle eye . . . if it did, he wouldn't be able to make barber poles out of smokestacks. ▶ Back in the days when 90 mph. was top speed, men learned that smooth, taut fuselage made for safety as well as speed, and Sherwin-Williams has kept step with aviation's finishing needs ever since, for fabrics, for woods, for metals. ▶ Ask the Key brothers, who set that 653 hour endurance record recently in the Ole Miss, what they think of S-W. Or Bennie Howard, who won the Bendix Trophy at the last Air Races. ▶ Today —because they're the best that can be made— S-W products are standard in factories, flying schools and private hangars everywhere.

Opex Q-B Clear Nitrate Dope
Opex Q-B Pigmented Dope
Opex Dope Thinner
Red Oxide Metal Primer
Opex Aero Enamels
Gas Engine Enamels
Airplane Spar Varnishes
Opex Polishing Compound

SHERWIN-WILLIAMS PAINTS

AEROPLANE FINISHES

SEE THE SHERWIN-WILLIAMS FINISHING ENGINEER

PRIVATE FLYING AND CLUB NEWS

Private Pilots Limited in Beam Use

INTENTIONAL INSTRUMENT flights in broken clouds or solid overcast within 25 miles of an airway, or within 25 miles of an airline airport may be made only by airline aircraft, or by planes carrying two-way radio, according to a temporary ruling of the Bureau of Air Commerce. Eugene L. Vidal, Director of Air Commerce, said that it will be effective until permanent airway and airport traffic control regulations are promulgated.

An intentional instrument flight is one in which the pilot takes off knowing that he will have to rely upon instruments and radio before reaching his destination, as distinguished from a flight in which the necessity for instrument and radio operation arises unexpectedly.

Instrument flying under simulated conditions for training purposes may be conducted, provided a safety pilot having unobstructed vision and with access to the controls of the aircraft accompanies the flight, and provided further that such flight does not enter broken cloud formation or overcast within the foregoing prescribed limits of airports or airways.

The order caused a flood of protests by private pilots throughout the country, the demands creating such a disturbance that special meetings were called to discuss the situation.

Air Shows

THE EIGHTH annual Miami All American Air Maneuvers, scheduled for December 12-13-14, are expected to bring together in Miami one of the greatest peacetime concentration of airplanes. The winter flying event has this year grown to such proportions that experienced aviation personnel from other Florida municipalities has been drafted to assist the Miami organization in handling the event. Eight hundred planes, military and civilian, are expected to participate.

The civilian planes will compete in daily speed contests, acrobatic flying contests and bomb dropping. Army, Navy and Marine Corps squadrons will stage maneuvers and military flying evolutions. One of the daily feature events will be a delayed parachute drop by Clem Sohn.

Approximately seventy-five National Guard planes are coming to Miami from eighteen states to take part in the meet. Sportsmen pilots from nearly every state in the nation have also signified their intention of attending.

Civilians will compete for $5000 in prize money and trophies. Events to be contested are the free-for-all, 200 cu. in., open cockpit or cabin; C licensed, 550 cu. in., or less, open cockpit; C licensed 800 cu. in. or less, open cockpit; C licensed 550 cu. in. or less, cabin; C licensed 550-800 cu. in., cabin, Curtiss Trophy; C licensed, free-for-all, any displacement; free-for-all, 375 cu. in. or less; free-for-all, 550 cu. in. or less, Col. E. H. R. Green Trophy; free-for-all, any displacement; aerobatics (by invitation); a women's handicap race; and special cash awards for new world records set.

The fifth annual air carnival held in October at Birmingham attracted such a gathering that not only was the show a success financially, but it may take its place with other leading shows in the country. On Sunday, the last day of the three-day event it was estimated that 50,000 persons surrounded the municipal field.

The show, which has been held annually in celebration of the establishment of the municipal airport was originally scheduled for early September, but was postponed to co-operate with national activities in making October a month for observing aviation.

In conjunction with the show a meeting of the seventh annual National Airport Conference was held at the Thomas Jefferson hotel. Col. Smith was the principal speaker and one of the principal subjects discussed had to deal with the organization of ground schools in aviation for adults under the Federal Emergency Relief Administration.

More than 25 airport representatives were present for the meeting which was presided over by Steadham Acker, manager of the Birmingham Municipal Airport.

Aviation Officials to Meet

THE FALL conference of the National Association of State Aviation Officials of the Northwest Region will be held at the Hotel Biltmore, Providence, R. I., on Dec. 4-5.

The meeting will be featured by a complete program of talks on various phases of aviation activities including airport development, intrastate airways, feeder routes, airport design and equipment, airport traffic, and a discussion of facilities for the private pilot.

The regional vice-president is Charles S. Dion, technical advisor and airport engineer of the Aviation Commission of the State of New York.

Club Activities

THE NEWARK, N. J., Division of the Flying Clubs of America held a meeting at the local municipal airport recently at which Lieut. L. V. Rawlings, flying instructor, lectured. The club has purchased an Aeronca and instrument flying will be added to its activities.

Orion Flying Club, which formerly limited its membership to National Guardsmen, has decided to accept civilian members. Lieut. J. J. McCarthy is president of the organization which maintains headquarters in Brooklyn, N. Y.

The Aeronautical Engineering Society of the Casey Jones School of Aeronautics held a dinner at which Jack Warren, of the Breeze Corporation, spoke on radio shielding.

Students at the University of Alabama, Tuscaloosa, have organized an aviation club with 60 members. The group plans to purchase a plane and is endeavoring to become one of the leading college flying clubs in the country.

Personnel Notes

APPOINTMENTS OF members to serve on the Alabama Aviation Commission include Theodore Swann, Tom McGough, J. B. Rutledge, L. G. Mason, and O. M. Barney. The board has an annual appropriation of $15,000 to carry on aviation work in the state.

G. Bancroft Hall has been appointed director of the Jordan Marsh Company-Boston Traveler Junior Aviation League, succeeding Capt. Willis C. Brown, who has taken over other duties with Jordan Marsh.

The Seattle chapter of the N.A.A. recently elected new officers for the next year. They are Allan Blum, president; Lieut. B. B. Smith, vice-president; Richard Rummel, secretary; and Mrs. Virginia Ogden Andrews, treasurer.

Mrs. Gladys V. Crooks has been reelected president of the Women Pilots of Seattle at Boeing Field. Other officers chosen for the ensuing year are Miss Mary Riddle, vice-president; Miss Mildred E. Filz, secretary; and Miss Edna Olson, treasurer.

Capt. John Donaldson, operator of the Donaldson Flying Service, has been named state director of the Alabama Aviation Commission, recently created by the Legislature.

Aero Institute Gets Bequest

A BEQUEST of $10,000 was provided for the Institute of the Aeronautical Sciences by the will of Dr. S. A. Reed, for the endowment of the Sylvanus Albert Reed Award. The award was established last year by Dr. Reed to be given annually for "a notable contribution to the aeronautical sciences resulting from experimental or theoretical investigations, the beneficial influence of which on the development of practical aeronautics is apparent."

The first award was made to Professor C. G. Rossby and Dr. H. C. Willett of M.I.T. for the practical application of the polar front theory of weather forecasting to American meteorological practice.

THE

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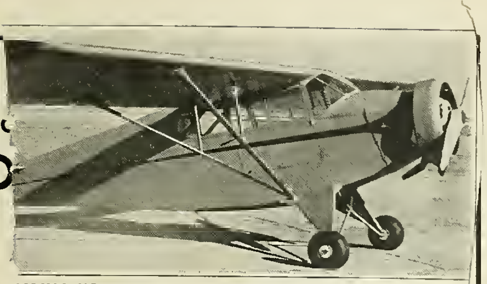

RWIN "Sportster"—Model 7000 A. T. C. 574

ok 8 Years to Develop the v Rearwin "Sportster"!

Th our experience and engineering skill, extending over ht successful years of airplane manufacture

E-9 *Aircraft* FUEL PUMP

The new EVANS E-9, latest development of the aircraft fuel pump, maintains correct gas pressure under all flying conditions. A sylphon relief valve assures constant pressure, regardless of the suction head, and a wabble pump can be used in conjunction without affecting the relief valve. The E-9 is a reliable, efficient, and foolproof heart for the motor.

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MACWHYTE

AIRCRAFT STRAND and CORD

● For controls—1 x 19 non-flexible, 6 x 7 and 7 x 7 flexible, 7 x 19 extra flexible. Preformed and Non-Preformed—Tinned, Galvanized and Stainless Steel. Made to meet Army-Navy specifications by wire rope specialists in the Macwhyte factory.

Makers of Tie Rods—Strand and Cord—Slings for aircraft

ADV. NO. 148

MACWHYTE COMPANY
KENOSHA, WISCONSIN

BERRYLOID

ZINC CHROMATE PRIMER P-27

GETS THE CALL FROM

BOEING!

● Berryloid airplane finishes score again! After subjecting many makes of primers to the most rigid tests, the Boeing Aircraft Company speaks for the industry when it says: "We are pleased to state that Berryloid Zinc Chromate Primer P-27 is a distinct improvement over the old iron oxide types from the durability standpoint and is much more satisfactory from the standpoint of production. We find that while the initial cost is considerably higher than we are accustomed to paying, the price disadvantage is not really considerable, due to the fact that the material is thinned 2 to 1 with Toluene, to obtain spraying consistency.

"Berryloid P-27 Primer is particularly necessary for use on cadmium plated steel parts on which it has formerly been almost impossible to obtain adhesion when using many standard types of finishes.

"We have definitely decided that on all future work, specifications permitting, we will use Berryloid P-27 Primer exclusively, this decision being based principally on the improved finish obtainable and on lowered production cost as well.

"It may interest you to learn that of the several zinc chromate primers tested, Berryloid was by far the most satisfactory, particularly as it does not go out of solution as do the others." Signed, C. B. Gracey, Assistant Purchasing Agent, the Boeing Aircraft Company.

BERRY BROTHERS

VARNISHES • ENAMELS
LACQUERS • PAINTS

DETROIT, MICH. • WALKERVILLE, ONT.

BERRY BROTHERS

THE INDUSTRYRIVATE FLYING
ND CLUB NEWS

14,763 Pilots Licensed

THERE WERE 14,763 pilots and 7,344 aircraft holding active Department of Commerce licenses on October 1, 1935, according to the Bureau of Air Commerce. On October 1, 1934, there were 13,812 licensed pilots and 6,798 licensed aircraft.

The total number of aircraft, licensed and unlicensed, of which the Department had record on October 1, 1935, was 9,139, while this number on the corresponding day of last year was 8,542. Aircraft bearing identification numbers only totaled 1,795 on the first of October, 1935.

Among the 14,763 persons holding pilots' licenses there were 7,377 transport, 969 limited commercial, 5,775 private, 638 amateur and 4 industrial pilots. The licensed pilots included 402 women classified as follows: Transport, 72; limited commercial, 27; private, 254, and amateur, 49.

Fairchild Production Gains

THE BUREAU of Air Commerce registered 83 Fairchild airplanes from January 1 to October 18, 1935, according to Sherman M. Fairchild, president of Fairchild Aviation Corp. Fifty-four planes were registered in the same period of 1934.

The majority were three-place, high wing cabin monoplanes, powered either with the 145 h. p. Warner Super Scarab or the Fairchild Ranger engine.

More Planes Sold

SALES OF aircraft are reflected in the increasing production figures inasmuch as production is keeping pace with deliveries. Among the planes delivered is a direct-control Pitcairn autogiro which has been purchased by the Army Air Corps for experimental purposes. If tests prove the equipment to be satisfactory, it is likely it will be adopted widely by the War Department.

R. C. Durant has taken delivery of a new Stinson Reliant, the sale being made through Aircraft Industries, Grand Central Terminal, Glendale, Calif.

Under a newly-signed contract, Stearman Aircraft Co. soon will deliver three Model 73 Lycoming-powered training planes to the Philippine Constabulary to form the nucleus of a new aviation unit in the islands.

The Mississippi River Fuel Corp., St. Louis, Mo., has purchased a Lambert-powered DeLuxe Monocoupe from the factory. The plane will be used in patrolling the company's 500-mile natural gas pipe line between Monroe, La., and St. Louis.

The St. Louis Flying Service, Robertson, Mo., sold two new Fairchilds and a new Cessna. F. D. Kessler, of Sunbury, Pa., bought a "24" Fa
Schrom, of Berwyn,
child. D. D. Walker,
took delivery on a fouss, Col. E. H. R.
Grand Central Flyinr-all, any displace-
factory delivery of twy invitation); a
high wing C-3 and on; and special cash
wing models powered records set.
C-70. In addition, th carnival held in
purchased a Stinson S. attracted such a
Charles H. Babb, use was the show a
at Grand Central Air it may take its
dale, Calif., reports theng shows in the
airplane sales: J-6 Trahe last day of the
engine to Robert Gods estimated that
Costa Rica; J-6-7 powered Stearman to TWA for instruction flying instruction; J-5 powered Stearman to M. Chojin, Alameda, Calif., and a tri-motor deluxe Fokker to Colonel Hutchinson, who contemplates using it to make a flying tour of the United States. Exports included a shipment of three engines to Australia.

Seventeen Fairchild models were delivered to purchasers between September 1 and October 16. All were the Fairchild "24"; three were powered by the Ranger in-line engine, and the balance by the 145 h. p. Warner Super Scarab.

Lockheed Aircraft Corp. has sold a fleet of Wright Whirlwind-powered Electras to Delta Air Lines and also recently completed delivery of five similar ships to Eastern Air Lines. In addition, the A. O. Smith Corp., of Milwaukee, purchased a P. & W. Wasp-powered Electra and a Lockheed Vega was sold to Philip P. Whitmarsh for exploration work in Africa.

Secretary Dern inspects the Pitcairn giro

:D, president
dent of the organization whi Worcester,
headquarters in Brooklyn, the board of
The Aeronautical Enginee Corp. Mr.
of the Casey Jones School ofociated with
held a dinner at which Jacoi New Eng-
the Breeze Corporation, spnager of the
shielding. nerican Steel
Students at the University o04 he was
Tuscaloosa, have organized a Iron Co.,
club with 60 members. The gr Wyman-
to purchase a plane and is endea the pres-
become one of the leading coll
clubs in the country. Curtiss-Wright Corp., has accepted the chairmanship of the Aeronautics Division of the United Hospital Campaign Committee, according to S. W. Reyburn, chairman of the Commerce and Industry Division.

At the Nov. 1 meeting of the General Electric Company's board of directors, Henry S. Morgan and Robert C. Stanley were elected members of the board to fill vacancies. Announcement was also made of the resignation of Thomas Cochran, former director who resigned because of ill health.

Samuel M. Jarvis has been appointed assistant to George Newman, assistant superintendent of Consolidated Aircraft Corp., in San Diego.

Kollsman Instrument Co. has appointed Commander Mario Calderara, of 47 Avenue de Brimont, Chatou (S. & O.), France, as their European director of sales. Commander Calderara has long been identified with the sale of aircraft instruments on the Continent. Another recent appointment by Kollsman is that of D. B. Richardson as general Latin American representative.

South American Sales Tour Planned

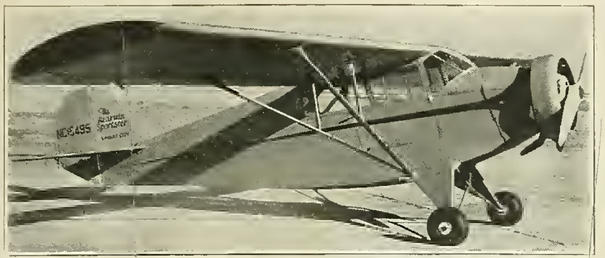
THE FIRST return visit by representatives of the North American aviation industry following the visit of Central and South American aviation leaders to the United States in October, will be made December 15, when O. J. Whitney and Burnham Litchfield leave North Beach in a Jacobs-powered Beechcraft.

This tour is a joint venture of the Beech Aircraft Co., the Jacobs Aircraft Engine Co., and the Fairchild Aerial Camera Corp. Equipment to be carried includes the commercial model of the Fairchild Kruesi radio compass, Fairchild K-3B and F-8 cameras and the CG-16 camera machine gun.

The tour will include stops in Cuba, British Honduras, San Salvador, Costa Rica, Nicaragua, Panama, Canal Zone, Colombia, Ecuador, Peru, Bolivia, Chile and Argentina.

Litchfield is a member of the Fairchild company.

(*Continued on following page*)



New REARWIN "Sportster"—Model 7000 A. T. C. 574

It Took 8 Years to Develop the New Rearwin "Sportster"!

ALL our experience and engineering skill, extending over eight successful years of airplane manufacture, are back of the new Rearwin "Sportster"—an airplane of distinctive design and high quality. Key Brothers, holders of the endurance flight record, selected the Rearwin after much consideration and are now distributors in the South. The new "Sportster" is a real achievement in airplane design and construction—Smart, Classy, Sporty—streamlined throughout. Dual controls. Commodious, comfortable cabin—50 lbs. Luggage including full size Gladstone! Perfect visibility. 24-gallon fuel tanks in wings. 70-inch Hydraulic landing gear. 70 H.P. or 85 H.P. LeBlond Motor. 20 miles on a gallon of gas at 98 miles per hour cruising!

$698.00 flies home a Rearwin "Sportster"—convenient payments for the balance. Get all details NOW!

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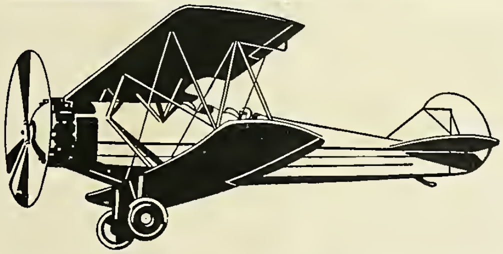
FAIRFAX AIRPORT
Kansas City, U. S. A.



If You're Grounded—

● If you are grounded for a re-cover job, ask at your service hangar about Glidair Fabricote—it may mean a saving to you of up to $200.00.

If, on inspection you find the finish is badly cracked and checked but, the fabric itself is in good condition, do not risk tearing the fabric trying to remove the old finish. Instead, rejuvenate with Glidair Fabricote. It will make cracks and checks disappear, tauten the fabric and the ship is then ready for a new application of Glidair Pigmented Dope.

You will save time and money and your ship will again be ready for the air.

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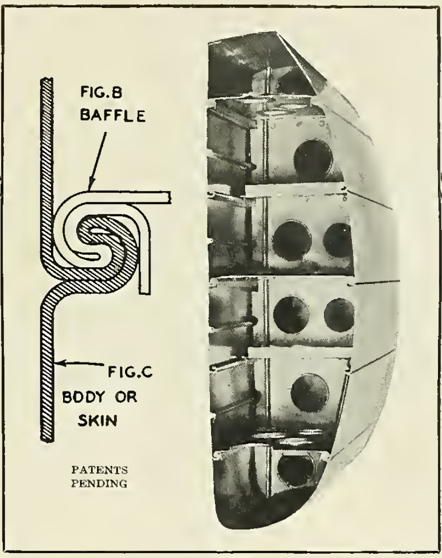

PARAMOUNT TANKS CAN TAKE IT

This new PARAMOUNT tank incorporates a newly designed hook type, rocker action track joint. In recent tests it was

Vibrated for 100 hours and drop-tested with an 80% overload. It showed no signs of failure.

Designs furnished for all aircraft requirements to be constructed under the new, exclusive and improved PARAMOUNT method.

Over 100 hours vibration guaranteed with every PARAMOUNT tank.

Without obligation send your prints for PARAMOUNT re-design and estimates.

All designs personally approved
by Ph. J. Billig, Chief Engineer

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Designers and Manufacturers of
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PARAMOUNT TANKS ARE BETTER

Pan-Pacific Auditorium which will house the aircraft show in February

(*Continued from preceding page*)

Aero Show to be Held in Los Angeles

THE NATIONAL Pacific Aircraft and Boat Show will be held Feb. 1-9 inclusive in the new Pan-Pacific Auditorium, Los Angeles, under the sponsorship of the California Air Industries Association, a group of Southern California manufacturers, distributors and operators which also sponsored the Western Aircraft Exposition in 1929.

According to Cliff Henderson, managing director, who will be associated with his brother, Phil, in managing the event, participation of almost the entire industry on the coast is assured, as well as that of leading manufacturers of aircraft, engines and accessories from other parts of the country. New models, particularly in the twin-engined private owner and feeder line types, will probably be ready for exhibition, he said.

The auditorium provides 110,000 sq. fit. of space in a concrete structure.

Harry H. Wetzel, vice-president and general manager of Douglas Aircraft Co., and president of the sponsoring group has appointed a show committee to work with the management in conducting the affairs of the exposition. This committee consists of Palmer Nicholls (Pacific Airmotive Corp.), chairman; Carl B. Squier (Lockheed Aircraft Corp.) and Walter P. Balderston (Pacific Scientific Co.).

New Aircraft Types Developing

SEAPLANE TESTS on a new Waco F-6 designated as the CPF are being made at College Point, Long Island where the plane was equipped with standard Edo 45-2880 floats. The plane is the latest of the three-place open F series and is powered by a Wright Whirlwind R-760 engine of 250 h.p. Department of Commerce approval on the model was obtained at a gross weight of 2880 lbs., and the plane shows a maximum speed of 142.6 m.p.h. at 2100 r.p.m.; a cruising speed of 127 m.p.h. at 1900 r.p.m. and a 19-second average full-load take off.

It is reported that Beech Aircraft Corp., is developing a twin-engined Beechcraft for 1936 production. It is indicated that this larger job will embody latest features in comfort and appointments, and will be designed for transport feeder service or may be fitted out as an executive flying boat. It will be powered by two 275 h.p. engines and will cruise about 185 m.p.h. The cabin will be arranged to seat six passengers. There will also be provisions for co-pilot in addition to the pilot. If desired, the cabin may be equipped with three or four easy chairs and divan together with a large baggage compartment in the rear.

Initial test flights of the 2-place Argonaut amphibion were successfully completed last month at the Consolidated airport in Buffalo. The ship is powered by a 125 h.p. Menasco Pirate C4 engine mounted as a pusher and shows a maximum speed of 120 m.p.h. and a landing speed of 40 miles per hour.

(*Continued on following page*)

Digest of Recent Events

China Clipper Makes Flight to Alameda

THE MARTIN flying boat *China Clipper* arrived in Alameda, Calif., after a two-stop trip from Miami, Fla., where she had been delivered to Pan American Airways. The first leg of the flight was from Miami to Acapulco, Mexico, a 1503-mile trip which was completed in 11 hours 3 minutes. From Acapulco, the four-engined ship flew to San Diego, Calif., 1600 miles away. This leg of the trip was completed in 12 hours 2 minutes, and the last hop to San Francisco, took 4 hours 10 minutes. Capt. Edwin C. Musick, a crew of five and six passengers made the trip to Alameda, which is to be the eastern terminus for the trans-Pacific service. NOV. 8-11

41 Navy Flying Boats On Long Mass Flight

FORTY-ONE Navy flying boats left Pearl Harbor, Hawaii for a 1380-mile flight to Midway Island, and stopped off at French Frigate Shoals, 550 miles from Honolulu. Six of the planes constituted a vanguard for the next hop when they left for Johnston Island under the command of Capt. Kenneth Whiting. The planes are Consolidated patrol flying boats and are on a routine maneuver flight. NOV. 9

U. S. Stratosphere Balloon Sets New Altitude Record

CAPTAINS ALBERT W. Stevens and Orvil Anderson, U. S. Army Air Corps officers, set a new world's record for altitude when they reached a height of 72,395 feet during a stratosphere flight which originated at Rapid City, S. D. The men landed at White Lake, 240 miles from the starting point after a flight of 5 hours 5 minutes. The height reached in this flight exceeds the unofficial record of 72,176 feet which had been claimed by the Russians, and the official 61,236 feet set by Lieut. Comdr. Settle and Major Fordney. The balloon was known as the *Explorer II* and its flight was noteworthy because of the constant radio communication with the ground. NOV. 11

British Fighter Does 300 m.p.h.

THE LATEST addition to the Royal Air Force, a Hawker interceptor, successfully passed initial test flights at Hendon, showing a maximum speed of 300 m.p.h. The plane is powered by a 12 cylinder in-line Rolls Royce engine, has retractable landing gear and trailing edge flaps. It is of the low-wing type of all-metal construction and has an enclosed cockpit. NOV. 11

Capetown-England Flight Record Lowered

DAVID LLEWELLYN and his pupil, Mrs. Jill Wyndham, landed at Hanworth, England, after a 6 day 12 hour 3 minute flight from Capetown. The time established a new mark and broke the old record held by Mrs. Amy Mollison made in 1932 at 7 days 7 hours 5 minutes. NOV. 11

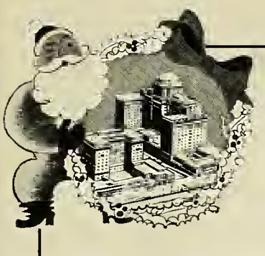
Jean Batten Flies Solo Across Atlantic

JEAN BATTEN became the first woman to make a solo flight across the South Atlantic when she landed her deHavilland Gypsy Moth at Natal after a 13 hour 5 minute flight of 1281 miles from Dakar, Senegal. Flying from Lympne, England, Miss Batten stopped at Casablanca, Morocco and at Villa Cisneros, Spanish Northwest Africa. NOV. 13

Russian Aviator Ascends 47,806 Feet

A NEW world altitude record for airplanes was claimed by Vladimir Konstantinovitch Kokinaki, after a flight which took him 47,806 feet above Moscow. This exceeds by 454 feet the 47,352-foot record officially recognized by the Federation Aeronautique Internationale (of which the Soviet Union is not a member), set by Commander Renato Donati.

Kokinaki established a new altitude mark for the Soviet Union two days previously, on that occasion reaching 42,640 feet above Moscow. He was up for sixty-two minutes in his record flight and came down with his fuel tanks empty. Kokinaki's flight was made in a plane especially designed for the stratosphere. NOV. 22



OUR

Christmas Greeting

HAS A SANTA CLAUSE IN IT

WHAT we want most for Christmas is to give you a merry family holiday at Chalfonte-Haddon Hall. Santa will be here to cram the kiddies' stockings, leave gifts for the grown-ups, and trim the towering Haddon Hall tree.

We've gone him one better by cooking up a Christmas Dinner such as Santa himself might covet. You can work up an appetite golfing, cycling, riding horseback on the sand.

Come down on Christmas Eve; the Boardwalk is a jolly, brilliant spectacle. Special holiday entertainments. Skating and ice hockey. Bring the family and stay the whole week.

$7 up at Chalfonte, $8 up at Haddon Hall, single, American Plan. $5 up at Haddon Hall, single, European Plan. Special weekly rates.

LEEDS AND LIPPINCOTT COMPANY

Chalfonte-Haddon Hall

ATLANTIC CITY

Lear-O-Scope

Aircraft Radio Direction Finder

Flight tested by scores of pilots —hundreds of hours of use under all flying conditions.

Write for descriptive booklet.

AILOR SALES CORPORATION

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Maintenance—Hangar 16, Roosevelt Field

NATIONAL PACIFIC

AIRCRAFT & BOAT SHOW

1936 AVIATION PREMIERE

Take leadership in the awakening and rapidly expanding market for all products and services of the aircraft industry.

Participate with the Nation's outstanding aircraft, engine and accessory manufacturers in this mammoth, colorful and all-embracing inaugural presentation of the new 1936 creations—enhanced by the addition of water craft that will substantially add to the public appeal. Share the benefits to be derived from the truly great western market to which it will primarily cater. The entire industry will be there.

The magnificent new Pan-Pacific Auditorium in the heart of uptown Los Angeles' business center furnishes the setting. It is admirably designed for luxurious aircraft arrangements at moderate cost. Its 110,000 square feet of exhibit space affords display of large craft without crowding. A 60-foot service door permits placement of completed craft without dismantling.

Here manufacturers, distributors, operators and executives in every department of aviation will be in attendance. *For further details write Clifford W. Henderson, managing Director, 7600 Beverly Blvd., Los Angeles.*

Sponsored by
CALIFORNIA AIR INDUSTRIES, ASSN., LTD.

LOS ANGELES

FEB. 1 TO 9

(Continued from preceding page)

Indiana Firms Active

ARUP MANUFACTURING Co., South Bend, Indiana, has completed its fifth model of the single-wing plane which it has demonstrated at aviation meets and before Army and Navy inspectors.

The latest model, of seamless tubing, is powered with a 70 h.p. LeBlond engine, and has a two-place enclosed cabin, with dual controls. Lieut. Brown of the Indiana National Guard put the ship through its test flights.

Negotiations also have been under way at South Bend, and at Warsaw, Ind., for the removal to one of these cities of the plant of the International Aircraft Corp. now at Niles, Mich. The company has produced the Heath airplane and present plans are said to call for the production of a two-passenger ship.

Financing operations of Skycraft, Inc., are being conducted in Indiana to enable the production on a commercial scale of a new single-wing plane of the flying wing type, the design of Ralph R. Graichen, formerly chief engineer of the Arup Manufacturing Co.

The plane is to be powered with a 90 h.p. Ford V-8 engine and is expected to have a cruising speed of 92 m.p.h., and a landing speed of 20 m.p.h.

Approved Type Certificates

THE DEPARTMENT of Commerce issued approved type certificates covering aircraft as follows:

Curtiss-Wright Airplane Co., St. Louis, Mo., model CA-1, a 5-place cabin amphibion biplane powered by a Wright Whirlwind R-975E-1 engine (365 h.p.). ATC 582.

Waco Aircraft Co., Troy, Ohio, model CPF, a 3-place open biplane powered by a Wright Whirlwind R-760E engine (250 h.p.). ATC 583.

Lockheed Aircraft Corp., Burbank. Calif., model Electra 10-B, a 12-place monoplane powered by two Wright Whirlwind R-975E-3 engines (440 h.p. each). ATC 584.

Glenn L. Martin Co., Baltimore, Md., model Martin 130, a 52-place flying boat powered by four P. & W. Twin Wasp S1A2-G engines (830 h. p. each). ATC 585.

1936 Races Expanded

A PROGRAM designed to encourage new racing craft developments in several cubic inch classifications, and $60,000 in cash purses are features of the 1936 National Air Races which will be held at the Cleveland Municipal Airport, September 3-6, 1936.

According to Cliff Henderson the $60,000 has already been committed, thus allowing 10 months for the development of special racing designs.

The Thompson Race will pay $20,000; the Bendix $12,500. The 550 cu. in. races including the Greve Trophy races, involve $13,000, while $9,000 has been set aside for 375 cu. in. races, and $2,400 for 266 cu. in. events. In addition there will be a women's ATC event valued at $1,500, and a men's ATC event valued at $1,000.

Bonuses for new National Air Race records will be paid in the Thompson, Bendix, Greve and 375 cu. in. events. Winners will receive 40% for first place, 25% for second, 14% for third, and 9, 7 and 5 percent for fourth, fifth and sixth places, respectively.

Operators Quit Aero Chamber

AIR TRANSPORT operators holding air mail contracts have resolved to withdraw from membership in the Aeronautical Chamber of Commerce to carry out the spirit as well as the letter of the new air mail legislation which provides that there be a definite line of demarcation between manufacturing and operating companies.

The Aero Chamber therefore will continue as the trade association for the manufacturers of aircraft, engines, parts and accessories. The resolution of the operators will be considered at a meeting of the governors of the Aeronautical Chamber when they meet in Washington, D. C. on Dec. 9.

(Continued on following page)

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(Continued from preceding page)

September Exports $1,160,374

STATISTICS ISSUED by the Bureau of Foreign and Domestic Commerce of the Department of Commerce show that during September 1935, foreign purchasers spent $1,106,374 for American aeronautical products. Sales of fifty planes brought $654,828, and parts and accessories totaled $324,667. The sale of twenty-eight engines produced a revenue of $126,783 and $54,096 more was the result of parachute exports.

Although Siamese purchases of eleven planes were worth $292,600, Brazil imported the greatest number, 22, but these planes brought only $153,788. Other countries importing American aircraft were Mexico (3), Great Britain and Ecuador (2 each) and 1 each by Italy, the Netherlands, Canada, Argentina, China, British Malaya, Japan, Philippine Islands and the Union of South Africa.

Japan spent $50,020 for 7 engines, and Australia also purchased a similar number. Italy and Sweden imported 3 engines each, 4 went to Brazil and 1 each to Panama, Mexico and British Guiana. Rumania made one of the largest imports of parachutes in some time, $49,800 changing hands during the month. The best importer of parts and accessories was Brazil with $44,966.

Fifty-four countries purchased our products during September, helping swell American exports for the first nine months of 1935 to $11,214,999. Total 1934 exports included 490 planes, 1007 engines, $98,466 for parachutes, and $4,808,130 for parts and accessories, the whole amounting to $17,548.181.

Business Reports

NET PROFIT of United Aircraft Corp. for the quarter ended Sept. 30, 1935 was $237,884.35 which is equivalent to 11 cents a share on 2,087,532 shares of capital stock which will be outstanding when all exchanges of United Aircraft & Transport Corp. common stock have been effected. Profit from operations amounted to $138,648.65 which was increased by other income, but the final operating figure for the third quarter was effected adversely by labor difficulty during the period. The total net profit for the nine months ended Sept. 30, amounts to $491,314.06.

Further manufacturing profits were evidenced in reports from the Curtiss-Wright Corp., and the Irving Air Chute Co. The former showed a net profit of $67,523 after depreciation, interest, taxes, etc., for the quarter ended Sept. 30, 1935 compared with a net loss of $62,880 in the preceding quarter. Loss for the nine months ended Sept. 30, was $192,705 after depreciation, interest and taxes. Wright Aeronautical Corp., a subsidiary of Curtiss-Wright had a net profit of $184,457 for the September quarter compared with a net profit of $436,958 for the third quarter of 1934. Irving Air Chute directors declared an extra dividend of 25 cents in addition to the regular quarterly disbursement of 15 cents. Dividends are payable Jan. 2 to stockholders of record Dec. 16. The company reported nine months' earnings of $273,012, more than six times the profit reported for the similar period in 1934, the profit thus far being equal to $1.37 a share.

Other reports for the nine months period ending September 30, were made by North American Aviation, Inc., and American Airlines. J. H. Kindelberger, president of North American, reported a consolidated net loss of $150,887.40 after depreciation of $470,340.15, but before including an accounted profit of $33,205.20 realized from the sale of securities. Including the latter, the first nine months of the year showed a net loss of $117,682.20.

American Airlines also showed a net loss for the period, this amounting to $397,545, after depreciation, operating expenses, interest and other deductions. Operating revenue was $4,367,805 and operating expenses, excluding depreciation which was $838,388 was $3,916,829. Interest and other deductions amounted to $10,133.

Republic Steel Co., has acquired the controlling interest in the Truscon Steel Co., one of the largest steel fabricators in the country. Republic executives are preparing to coordinate the Truscon plant and distributing facilities with their organization.

COMING EVENTS

Northeast regional members of the National Association of State Aviation Officials will meet at the Hotel Biltmore, Providence, R. I. Dec. 4-5.

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The Eighth Annual Miami All-American Air Maneuvers will be held at Miami, Fla. Dec. 12-14.

•

The National Pacific Aircraft and Boat Show will be held at the Los Angeles Pan-Pacific Auditorium under the management of Cliff and Phil Henderson. Feb. 1-9.

•

Closing date for entries in the Seventh Annual W. E. Boeing Scholarships. Boeing School of Aeronautics, Oakland, Calif. Mar. 15, 1936.

•

An International Aero Exhibition will be held in Stockholm, Sweden. May 15-June 1, 1936.

•

1936 National Air Races will again be held at Cleveland Municipal Airport. Cliff Henderson, managing director. Sept. 3-6, 1936.

Jessop Steel Co., Washington, Pa., has acquired license rights to the manufacture of the Mo-Max type of molybdenum high-speed steel, patents on which are held by the Cleveland Twist Drill Co. The Jessop company will manufacture the product under the trade name of Mogul.

Second Clipper and S-43 Delivered

THE "PHILIPPINE CLIPPER" second of the trans-oceanic flying boats built for Pan American Airways by the Glenn L. Martin Co., Baltimore, was delivered to its owners November 18 following a 6 hour 5 minute flight from the factory to the airline base in Miami. This plane is an exact replica of the "China Clipper" and the "Hawaiian Clipper" the third flying boat now being completed.

The twin P. & W. Hornet powered 16-passenger Sikorsky S-43 amphibion has been flown to the west coast where it will be dismantled and shipped to Honolulu. There it will be put into service among the Hawaiian Islands by Inter-Island Airways. The plane was flown west by Capt. Charles I. Elliott, chief pilot in charge of operations of the airline and is the first of its type delivered. Other planes of this type have been ordered by various companies and will be seen in service in the future in Europe, the Far East, Hawaii and South America.

Factories Expanding

RADIO PRODUCTS' plant, recently purchased by the Bendix Aviation Corp., will be enlarged and remodeled at an estimated cost of $250,000. The principal products are to be "blind" flying instruments, including a newly-developed radio compass. The Bendix concern will begin production in the near future, according to Vincent Bendix, president.

A new, larger and modern manufacturing plant in Cleveland has been purchased by Simplex Products Corp., manufacturers of Simplex Molium piston rings and other replacement parts. The building is at 3830 Kelley Ave., and is large enough to accommodate the production necessary because of the development of new piston rings, other parts and a brake lining soon to be announced. The new quarters will be occupied sometime this month.

Champion Spark Plug Co., is now undertaking a plant expansion program which will involve all manufacturing departments. Construction work has been started on an addition to the main factory which will provide more than 50,000 sq. ft. of additional floor space. According to R. A. Stranahan, president, the program will increase production capacity to more than 7,000,000 spark plugs a year.

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3. Jacobs Beechcraft: 245 hours. Black and yellow; 70 gal. gas; turn and bank, rate of climb, metal propeller, radio $5,400

4. Wasp Stearman: 540 hours; 85 since major overhaul; yellow and brown; radio, turn and bank, rate of climb, landing lights.............$1,900

5. Loening Commuter: 537 hours. Maroon and cream; standard equipment....$3,000

6. Fairchild 71 on pontoons; Wasp B. Turn and bank, rate of climb, landing lights, just majored $2,800

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FOREIGN NEWS IN BRIEF

Australasia

NEW ZEALAND is constructing and surveying 70 airports and landing grounds in order to create a chain of landing grounds along air routes and provide others in or near the larger cities and towns. Twenty-nine facilities are under construction or completed at Taupo, Hobsonville, Rotorua, Gisborne, Wanganui, Tauranga, Hastings, New Plymouth, Stratford, Masterton, Feilding, Dannevirke, Te Kuiti, and Rukuhia (Hamilton) all in North Island and Wigram, Westport, Hokitika, Ross, Wehka, Mount Cook, Invercargill, Balclutha, Inchbonnie, Stoke, Mussel Point, Upper Okuru, Haast, Mahitahi River and Waibo, all in South Island.

Most of the work is being done by the unemployed. The work is regarded as important because of the recent or projected establishment of scheduled air services. Between Napier and Gisborne, in the North Island, and Hokitika and South Westland in the South Island, mail and passenger service are in operation, and those connecting Wellington, Nelson, Blenheim and Hakitika, and Palmerston North, Auckland, Blenheim, Christchurch, and Dunedin are expected to be established late this year.

WORK IN organizing a new main airline was undertaken by W. K. Brett, of the Shell company, in the course of a 15,000-mile aerial inspection tour of airport and aircraft service stations in West and Central Africa. Starting from Cairo, Brett flew by way of El Obeid, El Fasher, Abeshr, Fort Lamy and Maidugari to Kano, traversing Imperial Airways' proposed West African route.

STOCKHOLDERS OF Hillman's Airways, Ltd., have approved plans which will unite their company with four other independent companies in the most important merger of British air transport concerns yet considered. Services aggregating 2,200 miles in length and linking 25 cities and towns in the British Isles and western Europe will come under the control of the new combine, which is to be called Allied British Airways. With the exception of Imperial Airways, the new combine will be the largest British air transport concern.

WITH A capital of £250,000, Adelaide Airways, Ltd., has been formed to operate airline services with Adelaide as the central point. The company will start operations with a twin engined Pobjoy-powered Monospar and a Short Scion seaplane.

THE CIVIL Aviation Department plans an extensive ground organization, including new airports and emergency landing fields, in preparation for the proposed daily air mail services between the Australian capital cities.

THE FEDERAL Cabinet will be asked to extend the authority of the Civil Aviation Department, to give a greater measure of control of air services not conducted under Government contracts. The most important proposal is that all aircraft engaged in carrying passengers and mails should have a small radio transmitter to give their positions in the event of forced landings.

AERIAL MEDICAL services, pioneered in Queensland are to be established on a permanent basis in New South Wales, and for this purpose a non-profit making company, to be known as Australian Aerial Medical Services (N. S. W. Section) has been formed.

NEW ENGLAND Airways Ltd., has inaugurated service between Sydney and Townsville, via Brisbane, providing an important extension in air mail services.

WITH A total of £7,352,000, this year's appropriation for defence expansion is more than twice the 1934-35 figure, and includes an additional £340,000 over last year for Air force expansion. It is expected that the new fighting planes will comprise 10 new squadrons of 12 Hawker *Demons,* each with a reserve squadron of 12, bringing the total aircraft ordered under the three-year plan to 114, and the total strength of the Australian Air Force to more than 200 planes.

Canada

THE ONTARIO air service's plane, planned and constructed in Ontario, passed its third official test and was turned over to the Dominion Government whose inspectors will determine whether the machine is to be accepted as an approved type. Squadron Leader A. T. Crowley of the Department of National Defence, supervised the flying tests.

WITH A grant of 900 acres from the Nova Scotia Government for the projected air base at Sydney, support assured by New Brunswick, and growing public interest in other parts of Canada, the Irish-Transatlantic Corp.'s plan for air service between Great Britain and the Dominion is a stage nearer realization, according to C. H. Clendining, chairman of the company, who returned to Montreal after conferring with Laurent Beaudry, assistant Undersecretary of State for External Affairs; T. P. Coolican, assistant deputy Postmaster-General; and J. Wilson, controller of civil aviation, Mr. Clendining laid his plans before Hon. W. D. Euler, Minister of Trade and Commerce, and Hon. Ian Mackenzie, Minister of National Defence.

(*Continued on page 67*)

A Man's Gift

Well, the Old Boy's due for another visit. ⋆ ⋆ *What* to give? We won't attempt to offer suggestions for your entire list. But we *can* suggest appropriate gifts for those of your friends and associates who are connected with aviation. ⋆ ⋆ A subscription to AERO DIGEST, for instance, for those who are employed in the aviation industry. Or a subscription to THE SPORTSMAN PILOT for those who fly for the fun of it. A generous gift for especially good friends would be the Combination Subscription—one year of AERO DIGEST and one year of THE SPORTSMAN PILOT. ⋆ ⋆ These are gifts which you *know* will be useful, just as you find your own subscription useful. Also, they will show thoughtfulness on your part. They're a man's gift, no question about it.

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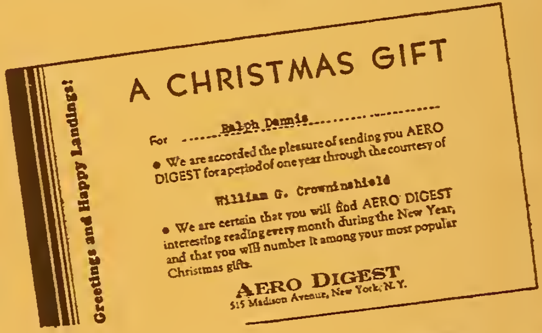

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Digest of Aircraft and Engine Machinery

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2. *APRIL—*

Digest of American Aircraft, Engines, Accessories

COMPLETE technical descriptions—with blueprints and photographs—of *every* commercial and private American airplane in production (including manufacturers' addresses, executive and engineering personnel, export representatives, etc.) Similar presentation of *all* American aircraft engines, and an illustrated list of American military aircraft, classified as to purpose, power, capacity, etc. Plus a directory of plane and engine accessories—their manufacturers, etc.

3. *JULY—*

Digest of Aircraft and Engine Materials

THIS issue will outline in feature articles the relationship between aviation and the industries which furnish its materials of manufacture—aluminum, steel, brass, bronze, wood, fabric, paint, glass, rubber, etc. An up-to-date and handy directory will list the sources of supply of aviation's raw materials and fabricated parts—their plants, branch offices, aeronautical personnel.

4. *OCTOBER—*

Digest of Airport Equipment

FEATURE articles on airport management, layout and design, traffic, maintenance, government regulations, marine air terminals, airport radio, etc. A special directory lists the suppliers of airport equipment and materials—their headquarters and branch offices, full line of airport items, personnel in charge of airport matters, etc.

ALL FOUR ANNUALS INCLUDED IN EACH SUBSCRIPTION AT NO EXTRA COST

(*Continued from page 64*)

The airport at Sydney, which will include a hotel, would cost approximately $1,750,000. The harbor would be used as a seaplane base ten months of the year and the terminus for the other two months would be selected by Air Commodore R. H. Mulock, the organization's consultant in Canada.

Czechoslovakia

CONSTRUCTION OF the civil airport at Prague-Ruzyne, which was made possible through an allotment of $4,400,000, is progressing satisfactorily. Grading of the field (located about 5½ miles west of Prague) was finished last year. Roads were constructed and the airport is already supplied with electricity. Recently the building of 6 hangars having dimensions of 98′ × 164′ each, was started and a call for bids on the airport station was published. As work shops, garages and houses for the personnel are under construction it is expected that the airport will be ready for use at the end of 1935.

CZECHOSLOVAK State Airlines recently purchased a British *Sara Cloud* equipped with two Walter-Pollux engines which develop 450 h.p. each. The plane has a seating capacity of 10 passengers in addition to the pilot and radio operator and will be used between Prague and Split.

France

TRAFFIC FIGURES for the first quarter of 1935 reveal that Air France's traffic is considerably ahead of 1934 returns. There was an increase of 7,806 passengers when 28,879 were carried, mail increased 46,288 lbs. to 278,542, and express poundage reached 1,637,428 lbs., contrasted with 1,522,484 lbs. in the similar period of 1934. The most-traveled route was Paris-London over which 8,216 passengers flew. Next was the Paris-Lyons-Marseilles run which had 4,095 passengers, and the third most popular run, catering to 2,992 passengers, was between Paris and Amsterdam. Other routes, and the number of passengers carried are Marseilles-Tunis, 1548; Marseilles-Algiers, 1523; Marseilles-Cannes, 1004; Brussels-Malmo, 919; and Marseilles-Saigon, 556.

Great Britain

DETAILED DESCRIPTIONS by the Short company of their 31-ton *Sarafand* six-engined flying boat reveal a forward step in the development of marine aircraft. Six Rolls-Royce *Buzzard* water-cooled engines, each developing up to 930 h.p., provide the power. They are mounted in three tandem nacelles between the biplane wings. Maximum speed, with full disposable load of more than eleven tons is 150 m.p.h., and the range, carrying full military load, is 1,450 miles.

THE ROYAL Air Force expansion program calls for the establishment of thirteen additional civilian flying schools at which special students can take initial training before proceeding to Service training centers for advanced instruction. Eight of these schools are now being formed, and negotiations are under way for the remaining five.

A NEW Siddeley engine is the Cheetah IX, a seven-cylinder, air-cooled, radial power plant rated from 310 to 365 h.p. at 6000 ft. The engine is developed from the *Lynx*, but is slightly larger in dimensions and cylinderical capacity. Its normal speed is 2100 r.p.m. at which its 310 h.p. is produced. Dry weight is 641 lbs., showing a weight-to-power ratio of 1.88.

OUTPUT AT the deHavilland factory of *Tiger Moth* light trainer biplanes has been increased to meet demands of the new training schools established under the Royal Air Force expansion program. Powered by the 130 h.p. *Gipsy Major* engine, the plane reaches a maximum speed of 110 m.p.h., cruises at 94 m.p.h., has an initial rate of climb of almost 800 ft./min., and a service ceiling of about 16,000 ft. With its usual load of 18 gallons of fuel, its range is 282 miles.

FOUR AVRO Type 636 military biplanes have been ordered by the Irish Free State, which will use them for training purposes. These planes, in regular form, conform structurally to standard Avro design, having a welded steel tube fuselage with wooden formers and stringers. Aft of the engine is a sheet of aluminum cowling which extends to the front cockpit, and the wings and tail unit are built up of steel strip spars and ribs.

EIGHTEEN GAUNTLET one-place fighters are being built under license in Denmark for the Army Air Service. Powered with a Bristol Mercury supercharged engine, this plane attains a maximum speed of 231 m.p.h. at 16,000 ft.

The English counterpart, designed and built by the Gloster company, which is now a subsidiary of Hawker Aircraft, Ltd., carries full day and night fighter equipment, including night flying gear, navigation lights, complete radio apparatus, and oxygen equipment. Its armament consists of two fixed Vickers guns. Fuel load is sufficient for several hours' cruising on patrol. Service ceiling is 35,500 ft. and climb to 20,000 ft. takes slightly less than nine minutes.

THE NEW Hawker *Hector*, biplane powered with the 24-cylinder *Dagger* engine which is to be added to the flying equipment of army co-operation squadrons, is the first to be equipped for general service use with an H-shaped engine, a type of power plant designed by Major F. B. Halford and developed by him in conjunction with the Napier company.

The *Dagger* engines that are now being built at the Napier works for installation in *Hector* planes are moderately supercharged to give best performance at 3,500 ft., where they are rated at a normal output of 700-725 h.p. At the maximum power altitude of 5,000 ft., they deliver 780-805 h.p.

THE REGENT House of Cambridge University has accepted £10,000 offered by Sir John Siddeley to promote aeronautical research in the University. Aeronautical research at the University is directed by Prof. B. Melvill Jones, who has specialized on streamlining and the reduction of head resistance.

FIRST OF the new class of general reconnaissance squadrons, seven of which are to be established as part of the Royal Air Force expansion program, will begin forming at Bicester towards the end of this month. Six other similar units will be set up soon afterwards. These units will be equipped with the new Avro *Anson* twin-engined monoplane, nearly two hundred of which have been ordered by the Air Ministry.

THE HESTON *Phoenix*, now going into production, is a five-place cabin monoplane designed for commercial transport and the private owner. It derives power from a 200 h.p. deHavilland Gipsy-Six mounted under a streamlined cowling in the nose of the fuselage, and it cruises at 125 m.p.h. Its maximum speed is 145 m.p.h. Cruising duration is four hours, or 500 miles, and landing speed is 55 m.p.h.

Italy

ITALY'S FIRST international aircraft show, held from Oct. 12 to 28 in the Milan "Palazzo dello Sport" attracted more than 600,000 persons who inspected the products of 249 exhibitors from Italy, France, Germany, Russia, Poland, Czechoslovakia, and the United States.

Among the exhibits were the record-breaking Macchi Castoldi M72, fastest plane in the world; the Cant Z501 which held the distance record, and the French Caudron in which Raymond Delmotte set speed records for 100- and 1000-kilometers. Only one plane from the United States was shown, this being a Ranger-powered Fairchild.

Interior of the Milan exposition hall showing planes exhibited at the first international Italian aircraft show

An inspection of the aircraft revealed a tendency toward the use of all-metal designs; a desire to clean up designs for better aerodynamic efficiency; a leaning toward the use of retractable landing gears; and a definite trend toward the adoption of monoplane, rather than biplane, types.

The Italian show will be held every second year, alternating with the Paris Aeronautical Salon.

AN AGREEMENT for the immediate opening of a passenger line between Italy and its Colonies in East Africa has been concluded between Italy and Egypt, the pact granting Italy the right to fly over Egypt en route from the borders of Cyrenaica to Assuan and to utilize Egyptian airports.

Mexico

CONCESSION TO operate passenger, mail and express service between Monterrey, capital of Nuevo Leon state, and Nuevo Laredo, on the American border, has been granted Compania Aeronaves de Mexico, S. A. by the Ministry of Communications and Public Works.

MEXICAN AVIATION Co. and Aerovias Centrales, S. A., both Pan American subsidiaries, the two largest aviation companies operating in Mexico, have been authorized by the government to reduce by 50 percent their express charge for carrying newspapers, magazines and other periodicals on their lines, in combined service over both their systems, and in conjunction with Pan American, to several Central American communities.

THE MEXICAN GOVERNMENT is constructing an airport on the Maria Madre, largest of the Three Marys Islands, Mexico's penal settlement, about 100 miles off the west coast, for regular air service between the mainland and the colony. A military field also has been established at Zimapan, Hidalgo state.

TWO FORD-TRIMOTORED planes have been put into service by Compania de Communicaciones Aereas de Veracruz, S. A., which operates passenger, mail and express airlines between Jalapa, Corooba, Vera Cruz state. Operation of passenger, mail and express service between Oaxaca City and Pinotepa Nacional, Oaxaca state, and Tehuacan, Puebla state, by Servicios Aereos del Pacifico. S. A., has been authorized.

SEMI-WEEKLY passenger, mail and express service has been started between Mexico City and Tuxtla Gutierrez, Chiapas, with a stop at Oaxcaca City, by Cia. de Transportes Aereos de Chiapas, S.A. Flying time between the terminals is three hours.

Francisco Aroza who made a record inverted flight of 280 miles in South America

SUBSTITUTION OF native-born Mexicans for foreigners as members of the crews of transports is being done in such a way that disruption of service is avoided and maximum of safety for passengers is assured, according to the Ministry of Communications and Public Works. Only Mexicans who are thoroughly versed in their profession are being assigned to these jobs. On Oct. 3, 40 Mexicans and 31 foreigners held transport pilot licenses, but on Oct. 21 there were 42 Mexicans and 21 foreigners.

PURCHASE OF ten combat planes for the military air force from American factories at a cost of 1,200,000 pesos (about $286,000) before the end of this year has been approved by President Cardenas. Planes will reenforce the first and second air regiments. Ministry of War and Marine announced that 25 army planes have been reconditioned in government's aircraft factories in Mexico City, and that two army planes have been successfully employed in scouting and bombing and machine gunning rebellious elements in Jalisco.

South America

FRANCISCO AROZA, instructor of the Aero Club of Rosario, Argentina, broke the world's record for inverted flight by flying from Parana, Argentina to Buenos Aires, a distance of about 280 miles. After arriving over Buenos Aires he flew over the airport until he had completed a total of 4 hours 25 minutes of inverted flight. The flight was made in a standard Fleet trainer equipped with a 100 h.p. Kinner engine.

Aroza was followed in his flight by four other airplanes containing official observers, and the flight was duly certified by the president of the Argentine Chapter of the Federation Aeronautique Internationale.

THE KONDOR Syndicate was to extend its weekly service from Buenos Aires to Santiago, Chile, October 7, when the first 14-passenger Junkers Ju 52 plane was to arrive at Los Cerrillos airport. The return flight was scheduled for October 9. The Kondor Syndicate has operated for everal years in Brazil and extended its service to Buenos Aires some time ago. This extension, coupled with the German service between the Brazilian coast and Germany, permits air mail carriage between Santiago and Europe in 4½ days.

BEFORE ADJOURNMENT of the Argentina Congress, appropriation bills were passed carrying 22 million pesos for the Army Air Corps and 20 million pesos for the Naval Air Service for the purchase of airplanes and equipment. This sum is to be spent over a three-year period with a provision that not more than 7½ million pesos for either service may be spent in one fiscal year. This program is designed to place the Argentine Air Services in the lead in South American military aviation. The purchases will embrace all types of aircraft.

Recently in Moscow 150 persons jumped simultaneously with Irvin Air Chutes from six large transport planes.

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BOOK REVIEWS

INSTRUMENTS AND ACCURATE MECHANISM

By Thomas North Whitehead

• WRITTEN FOR those who design or use instruments and accurate mechanism, *Design and Use of Instruments and Accurate Mechanism* will appeal to practical scientists as well as to a large class of engineers.

A somewhat novel analysis of the functioning of accurate mechanism results in a systematic consideration of the principles underlying its design and use.

Up to the present the only coherent theory of error, as applied to mechanism, was evolved as an application of the theory of probability and has only a limited utility.

In this book the author draws on his experience, both as a designer and as a user of instruments and mechanism, to analyze the actual physical causes of inaccuracy, and to consider these in relation to practical problems of design and use. He gives a wide variety of instances and illustrations.

The author is assistant professor of Business in the Harvard Graduate School of Business Administration.

WINGS ACROSS CONTINENTS

By E. Rusman

• THE OBJECT of this book is threefold. First it is hoped that it will enhance the pleasures of anticipation of a flight over KLM's Amsterdam-Batavia line. Second it is intended as a useful reference guide, and last it is expected to tell the passengers what they see from the plane on the way.

Even a hurried perusal reveals how adequately the book meets its objectives. A more detailed reading adds a store of historical background and a wealth of educational information concerning the interesting and enchanting lands traversed by KLM's airliners. Illustrations are plentiful, and the strip maps are a marvel of typographic and artistic development. The text is well-written and the author has adequately mastered the art of brief description.

Passengers using the KLM service are given a copy of the book, and a more worthy contribution to one's book shelf could hardly be desired. It is a pleasant reminder of an even more pleasant journey over one of the world's largest airline systems.

MARINE AIRCRAFT DESIGN

By William Munro

• PRINCIPLES AND practices of aeronautical engineering in their particular application to seaplanes and flying boats are discussed in *Marine Aircraft Design*. It presents simply and concisely the fundamental matter required for the study of this branch of aeronautical engineering, and provides technical data for the engineer and designer who desires to refer to facts and figures concerning his practical work.

The book opens with a discussion on the diversity of marine aircraft design, and the author reports outstanding advantages and uses of individual types. He then proceeds to a detailed, systematic examination of their design and construction. Aircraft dealt with range from 3000 lbs. to 20,000 lbs. gross weight for flying boats, and from 1500 lbs. to 5000 lbs. for seaplanes. Featured is a section of data sheets giving technical information in tabular and diagrammatic form.

Twelve chapters make up the balance of the book which is published by Pitman Publishing Corp.

FLYING FOR 1936

• THE THIRD edition of the Aeronautical Chamber of Commerce junior aircraft annual published under its new title *Flying for 1936,* contains as usual a wealth of aeronautical information. In the 256 pages there are 12 chapters on different branches of flying in the United States including private, military and commercial, and manufacturing activities.

The operations of all the airlines of the United States are described in detail, as are the activities in the various aircraft, engine and accessories plants, along with their plans for the new year. Airports and airways, airships and balloons, what the private owners do with their machines and how aerial service operators make a living, each phase of aviation has a chapter to itself. The chapter on training for aviation offers illuminating facts about the opportunities for young men in the industry.

Our Air Force

(*Continued on page* 16)

Frank M. Andrews, commanding the GHQ Air Force, should not be made a Major General. He thus at least will be equal in rank to the officer in charge of training and procurement.

The Air Force commander has no fields of his own from which to operate; he uses fields controlled and operated by Army Corps Area. He commands an Air Force while it is in the air, but he has no control over its ground bases. Was anything more unworkable ever devised? It apparently was devised to keep the Air Force under the control of the ground army, and to hamper its movements if ever those movements went against ground army policy. For instance, it has been deemed expedient to parade the Air Force in Florida this winter. There will be about 135 modern airplanes in the maneuvers. But to effect even this insignificant concentration of fighting planes several weeks of intensive staff work have been expended trying to correlate the work of the Air Force and the Army Corps Areas.

It is my conviction that the present control by the War Department and divided control within the Air Corps itself, will not work out to the advantage of national defense.

The progress of aviation has resulted in a theoretical assignment of targets far beyond the reach of any existing ground forces. On the Naval side, it has partly supplanted Naval sea power, and has enabled land-based aviation to perform many missions which heretofore could be accomplished only by the Navy, such as the bombardment of Naval forces far off our coasts.

Aviation has this new, extended defense duty to perform, as well as that cooperation with ground operations to which ground officers give such unbalanced weight.

If the Army is to retain control of aviation, it is fair to ask how much aviation is needed in the United States to provide an adequate air defense. It is obvious that for pure air defense the size of our air force can bear no relation whatsoever to the size of our ground force. Yet as a result of the Air Corps being a part of the Army, its appropriations are limited to its share of Army appropriations, in attempts to make air a balanced part of a ground organization.

It is a reasonable public demand to build up a first line of defense such as the Air Corps. It seems most unreasonable to jeopardize our national defense by restricting its development to a small share of the War Department's purse. If the Air Force can reasonably be considered a part of the balanced ground force, then perhaps the General Staff will tell us *what is the unit of measurement* by which the number of airplanes for air defense is measured in terms of Infantry, Cavalry, and Artillery? What is the answer?

It is my opinion that there is one way, and only one way out of this morass of muddled ground thinking. Form a Department of Air under its own Secretary of Air, responsible only to the President. The United States Air Force should be co-equal with the Army and the Navy, permitted to develop our air defense in the best interests of national defense. Only when that is done will a start have been made to achieve a measure of security for our country.

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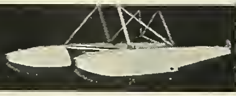

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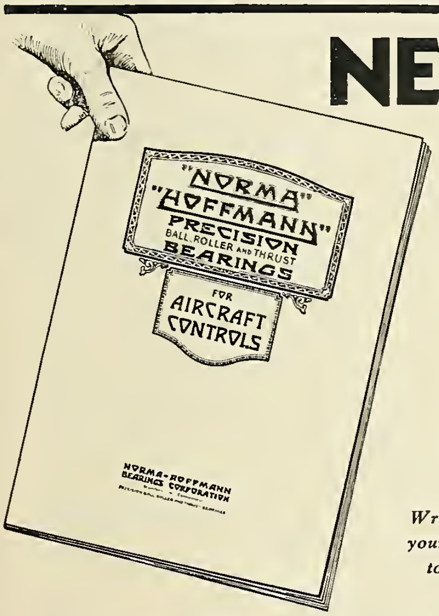
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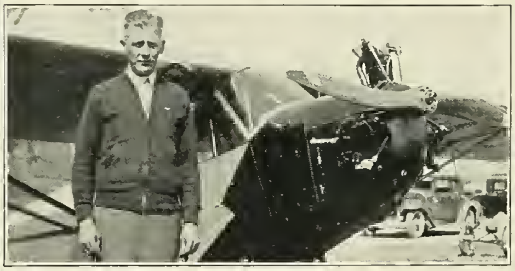

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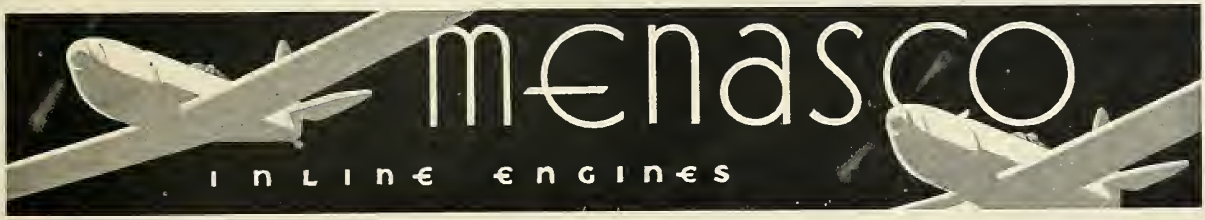

Personairlities

(*Continued from page* 23)

men are. However, it happened that what he was selling was in the famous Burkburnett Oil Field in northern Texas, and the investors received 325% dividends in 18 months. Jim just got his commission. It was all very sad.

In 1919 he returned to Baltimore and took a position as a bond salesman for a New York bond house, which he held for nearly four years. In 1923 he became a Lieutenant in the 104th Observation Squadron of the Maryland National Guard and was active with that outfit until 1929. During that time Jim had three crack-ups due, he says, to his own stupidity and slow thinking. Jim is one of the few pilots I have encountered in a long and sad life who has the honesty and courage to admit that his crashes were due mainly to his own dumbness. I admire him for his courageous admission, and suggest timidly that a lot of the rest of us would be more honest if we had admitted likewise about our own mishaps. Usually we blame aviation. Jim Erdman gives credit to Col. William D. Tipton and Lieut. Tom Bourne of the 104th for much valued guidance in the gentle art of flying. I also received invaluable instruction from the good old Colonel in the art of conducting myself as I should at banquets, at which he is a past master, as he is in flying.

In 1927 Jim Erdman began flying commercially—he'd been doing it for fun before—eking out a few extra sandwiches by selling Ford cars. During the next six years he operated various airports with the usual features of instruction, charter trips, and photographic work. The last one where he had been associated for five years, he bought at a sheriff's sale, and it cost him more than $12,000 in actual cash, a large portion of which he borrowed from various optimists, who have been growing steadily less optimistic year by year, for he still owes them part of it. But they needn't worry for the old demon demonstrator of Taylor Cubs will come through eventually. Unfortunate circumstances may knock a good man down; but he'll get up again every time, and win out in the end. However, I hope that statement of mine doesn't kid Max Baer into getting up again and going after Joe Lewis.

Flight Log

(*Continued from page* 20)

minutes will be required for the descent, and this time is subtracted from the estimated arrival time.

Referring to the indicated airspeeds during the descent, it will be noted that they are increased materially. Due to the changing altitudes and temperatures, however, the true airspeed will first increase, and then decrease, until finally it will be somewhat less than the true airspeed and cruising speed. We may also generally assume that the pilot will be cruising at altitudes where winds are most favorable, thus on the average, the ground speed during the descent will average about the same as the cruising ground speed. This is generally assumed, though individual pilots through experience will make small allowances for particular circumstances.

At the completion of his trip, the pilot turns in his Flight Log plus his Flight Plan and his clearance forms with weather and wind aloft data. With this information, the pilot or the supervisory personnel can readily check the entire flight, and can determine what, if any, improvements could be made in the method of execution. These "post mortems," particularly where pilots on similar flights compare notes, are most instructive. Statistical data on these forms as compiled by the navigation engineering department, has shown a steady increase in the accuracy of the work, and the efficiency with which the flights are carried out.

Trans-Pacific Service

(*Continued from page* 27)

trols and allowing unhampered attention to the problem of navigation during flight.

There is one item which has yet to be covered before the entire story of trans-Pacific service can be finished. It concerns the Martin flying boats, three of which have been ordered, two already delivered. Named the "China Clipper" and the "Philippine Clipper" these planes are the largest transports of their type in the world. The third Martin to be called the "Hawaiian Clipper", will be an exact duplicate of her two predecessors. Having a gross weight of 51,000 pounds, and a wing span of 130 feet, these planes represent one of the greatest achievements in aeronautical construction. They derive their power from four Pratt & Whitney twin row 14-cylinder Wasp engines, each capable of developing 830 horsepower, and delivering the power which gives their maximum speed of 179 miles an hour, a cruising speed of 157 miles an hour and a service ceiling of 20,000 feet. Flying from Baltimore to Miami on its first long flight, the "China Clipper" covered the 1200 miles in 7 hours 45 minutes, and the "Philippine Clipper" made the same trip in 6 hours 5 minutes.

They can be used for dual purposes. For ocean service they will carry cargo, 18 passengers with sleeping accommodations and a crew of 7. On other sections of Pan American Airway's operations, they will be arranged to carry from 36 to 43 passengers.

When the "China Clipper" started her inaugural flight, she carried almost 110,000 letters. Bucking headwinds that compelled Capt. Musick to swing southeast 200 miles, the first leg was completed in 21 hrs. 2 min. A day's delay, and the Clipper again was off from Honolulu to Midway. In this flight, with clearing weather, the plane reached her second goal in 8 hrs. 56 min.

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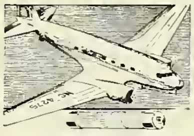

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Intake valves, new	4.95	"
Pistons, with pins and rings, new	6.95	"
J-5 Exhaust manifold, new	27.50	"
Thompson exhaust valves, new	5.95	"
Fuel pump (engine driven)	6.95	"
Rocker box—exhaust	1.75	"
Rocker box covers, new	.20	"
Intake or exhaust rocker arms, with bushing, new	1.00	"
Fuel pump adapter, new	2.95	"
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Cam drive pinion and shaft, new	6.95	"
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Crankcase, lower	9.75	"
J-4B cylinders with valves and springs, new	10.00	"
B.G. IXB and 4-A spark plugs, brand new	.37	"
AC Ball Top spark plugs, brand new	.10	"
15 amp.—15 volt generators, new	19.95	"
Eclipse, series 6, hand inertia starters	19.95	"
32 x 6 Bendix brake type wheels, used	7.50	"
32 x 6 Bendix non-brake type wheels, new	5.00	"
Dixie magnetos, No. 800	7.50	"
Dixie dual magneto switches	.75	"
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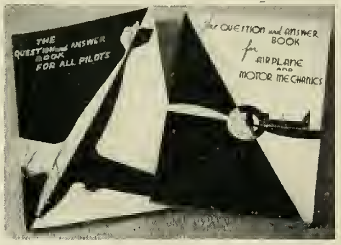

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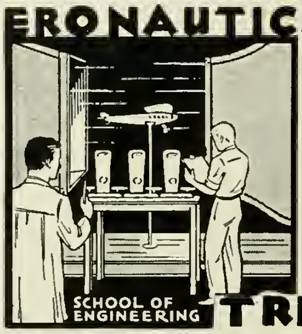

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FOR SALE: Waco F. Warner 125 h.p. Total time since completely rebuilt, 170 hours. Speed ring, Heywood starter, steel propeller; ship finished Berrychrome gunmetal and Berry red. The prettiest F in the country. Will consider trade. Southern Air Services, Inc., Municipal Airport, Memphis, Tennessee.

AIRCRAFT BARGAINS: Lambert Monocoupe with only 12 hours on motor, $1,400; Hess Warrior Argo, $775; fast Warner Monocoupe, just recovered, $2,000; fast J6-7 Cessna, $800; also J6-7 Waco, J6-5 Travel Air and OX Command-Aire. Cars considered in trade. Airport, Natick, Mass.

FOR SALE: 150 Hisso Eaglerock, $400. A-1 condition. Black and orange. Licensed to April 1936. William P. Mitchell, 64½ Main Street, Sanford, Maine.

WACO F: Kinner B-5 125 h.p.; total time, 190 hours. Flares, navigation and landing lights, Heywood starter; licensed, A-1 condition, $1,275. Mulzer, Norton Field, Columbus, Ohio.

GUARANTEED USED AIRPLANES: Our certified used airplanes: licensed and ready to fly away, include the following makes: Buhl Pup, Gipsy Moth, J6-5 Command-Aire (just recovered), Continental Waco Cabin and Stinsons from 1930 models up to and including new Stinsons which have had only a few demonstration flights. Will take in trades or finance any of the above. Stinson trade-ins preferred. Chicago Aviation Corporation, Glenview, Illinois.

AERONCA C-3: 1934. One year old. Only 380 hours total time. Guarantee ship to be as good as new. $1,150. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WACO 10: See it, fly it, $325 takes it. Terms arranged. Curtiss Junior, $425. Travel Air, $450. Write, wire Pioneer Aviation, c/o Airport, Syracuse, New York. (Picture furnished, 25c).

STINSON J-5 SM1D: Starter, heaters, new tires, majored motor, spun cowling, ring. Recovered fuselage, tail surfaces. Highest over $1,000 gets ship. Wilbur Sliker, Glen Gardner, New Jersey.

BEECHCRAFT: $5,500. Total time on ship, 375 hours. Total time on engine, 20 hours since new. Radio, landing lights, flares, rate of climb, thermocouple, 70-gallon tanks. Built in August '34. Also '35 model Aeronca, 200 hours, $1,300. Both ships excellent condition, priced for quick sale. Earl Ricks, Hot Springs, Arkansas.

SALE OR TRADE: J-5 4000 Travel Air and BBT Flood Light, good condition. Want 3POLB 100 or 125 h.p. Lee Flying Service, Sullivant Ave. Airport, Columbus, Ohio.

HUNDREDS OF AIRPLANES: Crack-ups, motor bargains. OX jobs, $100 up. Complete directory with owners' price, name and address rushed for 20c, postpaid. Used Aircraft Directory, Athens, Ohio.

FOR SALE OR TRADE: Licensed Whirlwind center section Eaglerock, 100 hours. Brakes, starter, instruments, 100 hours, like new. Private use. C. L. Rawls, 600 King Street, Charleston, South Carolina.

AERONCA C-3: Like new; enclosure, instruments, landing lights; $995. B. M. Lloyd, 1724 Oakland, Fort Wayne, Indiana. Will trade for larger plane.

FOR SALE: American Eagle biplane, licensed to July 1936. OX-5 Travel Air. Standard Steel propeller for OX-5. Dan Lake, Lake City, Kansas.

CESSNA, AERONCA-POWERED: Single place, cabin. Just refinished. Air wheels, cabin heater. Always hangared. Will sacrifice for $325. George Baxter, Marion, Kansas.

FOR SALE: 1934 model Waco cabin with Wright 250 h.p. engine. Total time, 475 hours; 100 hours since major overhaul. Ship in perfect condition. Exceptionally good finish, very clean inside, complete equipment. A real bargain. Troy Flying Service, Troy, Ohio.

STINSON 1933 RELIANT: Privately owned, 100 hours since major overhaul; 72-gallon gasoline, bank turn, special tan leather upholstery, special black and red paint, complete fairing including pants. Landing lights. Leech Aircraft, Inc., Armonk Village, New York.

FAIRCHILD 24: Less than year old. Built January 1935. 280 hours total time. Landing lights and starter. Cannot be told from new. $3,485. Will finance or take trade. St. Louis Flying Service, Lambert Field. St. Louis, Missouri.

VELIE MONOCOUPE: Only $395, flyaway. Terms arranged. Kinner American Eagle, $850. Hisso Eaglerock, $450. Call, write, wire (picture furnished, 25c). Pioneer Aviation, c/o Airport, Syracuse, New York.

STINSONS: We have guaranteed used Stinsons of following models: SM8A, S. R, and 1933 and '34 Reliants. These bargains have been taken in on new ships and put in first class shape, both as to appearance and mechanical condition. Special equipment on most of these ships. Will trade or finance. Chicago Aviation Corporation, Glenview, Illinois.

WASP-POWERED all-metal Flamingo: Just relicensed as eight-place; flares, landing lights, blind flying instruments, radio, electric starter; generator, new mohair upholstery, dual controls; a high-performing airplane priced to sell. Baker's Consulting Bureau, South Bend, Indiana.

FAIRCHILD 24: Ranger; demonstrator. Delivery July 1935; 270 hours; flaps, bank turn, red with black stripe; outside service for winter starting; selling in order to buy 1936 Ranger demonstrator. Leech Aircraft, Inc., Armonk Village, New York.

HIGH SPEED ARISTOCRAT: Pants, ring, fillets, etc. Tops 150. Radio equipped; red and maroon color; 600 hours total, 100 since major. Privately owned and always kept in best condition. Highest bid over $1,500 takes it. Bert Massey, Duncan, Oklahoma.

J-5 RYAN B-1: Excellent condition. $1,200 cash. 3-place Waco J6-7, many extras. $1,600. Ken Garrett, Pine Bluff, Arkansas.

CONSOLIDATED "FLEETSTER": Model 17, 8PCLM. Very little time; Hornet motor just majored by authorized Pratt & Whitney station. Ship just refinished in attractive colors. Relicensed. Can furnish float equipment for same. Wasp Stearman, 4-E, motor majored, sliding military windshield, starter, night flying equipment. Also J6-7 Cessna, J6-7 Travel Air 4-place; Avro Avian with new Cirrus motor; Boeing "95". Chuck O'Connor, Barnes Airport, Westfield, Mass.

FOR SALE OR TRADE: OXX-6 2000 Travel Air; motor and ship recently majored; licensed until October 1936. New prop; 3 hours time since majored; color, red and silver. Also '34 De luxe Plymouth coach, 20,000 miles, new General tires; trade either or both for 3- or 4-place cabin job, licensed. Grady Montgomery, 408 E. Main St., Jackson, Tennessee.

AERONCA C-3: Two-place, entirely recovered and rebuilt; perfect condition. Finished in red and blue. Less motor. Boulevard Airport, Philadelphia, Pa.

OX ROBIN: Perfect condition. $550. Will finance or take trade. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

AIRPLANES FOR SALE: 3 Fokker Trimotors, equipped 3 Wasp 420 h.p. engines; ships fully equipped, each $2,100. Lockheed Orion, $9,500. Fairchild "42", $1,850. Northrop Gamma, Cyclone engine. Many other ships. Babb, 1100 Airway, Glendale, California.

$490: WACO GXE, perfect condition, airwheels, brakes, full Miller, just refinished. Aeronca C-3, $775. Warner, Kinner parts cheap. Dick Schall (College Park Airport), Berwyn, Maryland.

1935 STINSON RELIANT: Repossessed. Licensed to carry five. Never damaged and used only 54 hours. Special paint, lights and flares. Will sell with or without following equipment: RCA radio, Smith controllable prop., turn and bank, rate of climb, manifold pressure gauge and carburetor temperature gauge. This is a new airplane at a real bargain. Aircraft Finance Co., Curtiss Airport, Glenview, Illinois.

WACO GXE: OX-5; semi-airwheels, Miller overhead, fuselage recovered, wings refinished; licensed, A-1 condition, $425. Mulzer, Norton Field, Columbus, Ohio.

DEADLINE FOR CLASSIFIED ADVERTISING, JANUARY ISSUE—DECEMBER 19th

Copy arriving after that date will be held over for the February issue

SECURITY AIRSTER: Two-place side-by-side, Kinner 100, 33 hours since major overhaul on ship and engine; compass, airspeed, silver paint; ideal ship for training. Leech Aircraft, Inc., Armonk Village, New York.

ARROW SPORT: LeBlond 65; speed ring, air speed; $275 for quick sale. A. Hartung, Room 2612, 20 Exchange Place, New York, N. Y.

B-5 WACO F: Excellent shape. Less than 400 hours total for ship and engine. Late type heads, Heywood starter. Always privately owned, hangared and never cracked. $1,500. Write or wire Box 1881, Dallas, Texas.

TAYLOR CUB: Aeromarine motor, winter enclosure, compass, bank indicator. Less than 300 hours; never damaged. Will give exceptional performance and satisfaction. $875. K. Russell Smith, 394 Wyoming Avenue, Wyoming, Pennsylvania.

AMERICAN EAGLE 201: Also Travel Air K-4000. Both Kinner K-5 powered. Excellent condition. Will finance part; or take ship needing overhaul or automobile in trade. Lake County Airways, Willoughby, Ohio.

CURTISS JR.: Like new. Licensed October 1935. Motor completely majored, fuselage recovered, new prop. $400 cash, or will finance at 6% to responsible party. P. Sturges, Geneseo, New York.

FOR SALE: Two 165 h.p. Continentals. One 210 h.p. Continental, equipped with Heywood starter; 20 hours since major overhaul. Felix Blum, Hangar 32, Roosevelt Field, Mineola, N. Y.

STINSON SM8A: Less than 200 hours, since modernized; complete night flying equipment, generator, straight-way compass, drift indicator, turn and bank, rate of climb. Fabric and appearance good. Asking $1,850. Address: Etta M. Summers, 2607 Edmondson Ave., Baltimore, Md.

STINSON: Model W; Wasp Jr. Original owner. Total time, motor 211 hours, airplane 166 hours. Color, blue and silver. Covering in excellent condition. Extras include: special blue leather upholstery, wheel pants, electric starter, turn and bank indicator, air speed, compass. License expires November 1936. This plane has always been housed in a steam-heated hangar and has had excellent care; never damaged. A real bargain at $2,500. Robert A. Lester, Fairway, Hutton Park, West Orange, New Jersey.

J6-7 PITCAIRN: Radio, blind and night equipment; motor majored, fuselage recovered, wings refinished, just relicensed; many extras, $1,750. Millerized Robin: Completely overhauled, new prop, wings refinished, fuselage recovered, re-upholstered; all new spars in stabilizer; excellent condition, beautiful finish, $750. 1935 Aeronca: Perfect condition; brakes, navigation lights, $1,395. J6-9 Stinson Jr.: Privately owned, just relicensed, excellent condition, motor majored, total time under 500 hours, $2,000. Sidles Airways Corporation, Union Airport, Lincoln, Nebraska.

GEE BEE SPORTSTER: Warner motor, brakes, steel prop, pants, speed ring, high gloss finish; perfect condition, never damaged. Boulevard Airport, Philadelphia, Penna.

STANDARD D-25: J-5 motor; ship completely rebuilt, recovered, 1934; special upholstery and instrument panel; blue and red; 213 hours since motor overhaul; ship should be seen. Leech Aircraft, Inc., Armonk Village, New York.

FOR SALE: 4 complete brand new 150 h.p. 7-cylinder Axelson B aircraft engines, $150 each. Three used engines, $100 each. Air-Parts, Inc., Glendale, California.

SIKORSKY S-38 AMPHIBION: Earth inductor compass, turn and bank, etc. 75 hours since complete major overhaul on ship and two Wasp motors; $7,000. Municipal Airport, Corpus Christi, Texas.

FOR SALE: Fleet model 2, Kinner K-5; new prop, ship completely rebuilt June 1935. $1,000. State College Air Depot, State College, Pennsylvania.

J-5 PITCAIRN: Model PA-6, $1,000. Blind and night equipment. Many other extras. Condition throughout excellent. A. M. Deemer, Jr., 3518 N. 2nd St., Wayne, Michigan.

FOR SALE: Trimotor Stinson, Model SM-6000-B Mail. Fully equipped for night flying, including radio. Plane and motors in good condition. Price, $2,350. Stinson SM8A Lycoming: In good condition, standard instruments including motor-driven generator, battery, electric starter and lights. Never cracked or abused. Price, $1,350. Sampson Held, No. 6, Floyd Bennett Field, Brooklyn, N. Y.

ENGINES: Majored by approved agency. Hornet B, $1,500; Hornet A-1, $750. Wasp S1-D1, $2,500; Wasp C, $1,100; Wasp B, $800. J6-9-D, $1,250; J6-7-D, $775; J-6, $450. Kinner B-5, $550; Kinner K-5, $300. Lycoming 215 h.p., $595. Babb, 1100 Airway, Glendale, California.

SALE: OX-5 Travel Air, perfect condition. Just recovered and relicensed until October 1936. Must be seen and flown to be appreciated. $600. No reasonable cash offer refused. Extra OX-5 motor complete. Robert G. Hinkel, 811 N. 39th Street, Philadelphia, Pennsylvania.

FOR SALE: Driggs Skylark, Rover-powered. In very best condition. Only 325 hours. Licensed June '36. Wonderful buy at $850. Ford Hurni, Hicksville, Ohio.

SACRIFICE FOR CASH: Kinner American Eagle, licensed to April, 1936. In first class condition. $475, flyaway Ocala, Florida. Johnson Wright, 1218 N. E. 2nd Ave., Miami, Florida.

CERTIFIED USED licensed airplanes: $300-$995. Write for free price list. December reconditioned bargains: Velie Monocoupe, $475; OX-5 American Eagle, $325; OX-5 Waco, extra motor, $465; OX-5 Travel Air, $475; OX-5 Robin, $475. Midwest Aero Brokerage Co., 3312 Olive, Kansas City, Missouri.

FOR SALE: Beautiful 2-place, low-wing airplane. Two Genet motors, airwheels, oleos, experimental license. Bargain for cash offer, trade considered. AERO DIGEST, Box 2193.

FOKKER 7-place: C-1 Wasp; 200 hours since major by approved station; radio, landing lights, flares, airwheels and shocks. Excellent condition. $1,250. Red Morrison, Helena, Montana.

125 WARNER ARISTOCRAT: 407 hours, always privately owned, never damaged, excellent condition. Townend ring, exhaust collector, oversize tires, bank and turn, navigation lights. Had factory major, 45 hours since top, $900. Irving V. Tier, Municipal Airport, Meriden, Connecticut.

SIMPLEX WARNER 125: 2 POLM; 260 hours; motor and ship in perfect condition; turn and bank, air speed and all regular instruments; cruises 110, very stable, new Bendix wheels and oversized tires, motor just top overhauled with new rings, navigation lights, booster; very economical; licensed to May 1936. Price $550 here. George A. Young, 119 Beach St., Shreveport, Louisiana.

$450 BUYS A beautiful American Eagle OX-5, A-1 condition; licensed until October 15, 1936. May be seen at Dansville Airport. Charles Duffy, Sonyea, New York.

LICENSED CURTISS-WRIGHT Junior: Just recovered. Engine has five hours since major. $350. Will take in car. Hayes & Wilson, 2407 Crescent Rd., Charleston, West Virginia.

WARNER TRAVEL AIR Sport, 12W: Engine recently majored, propeller retipped. Fabric excellent. Landing gear overhauled. Standard instruments, including compass, turn and bank. C. R. Rust, Lindbergh Field, San Diego, California.

HOTTEST WACO 10 GXE: Semi-airwheels, special built and painted. Many extras. No checks in fabric. 150 hours since factory rebuilt. Must see to appreciate. $485. Joe Stephens, 401 N. Penn, Webb City, Missouri.

STINSON SR5A: With flaps, Smith propeller, radio, night and blind flying equipment. Delivered November 1934. Perfect condition. Motor just majored. Bargain for cash. John Shohe, Boston Airport, East Boston, Mass.

TRAVEL AIR SPORT Trainer: Wright Gipsy engine, $925. Travel Air A-4000 model, Axelson engine, A-1 condition, $900. Trades considered. Also complete Axelson engine. Axelson and Wright Gipsy parts. J. W. Lytle, 2333 Vodeli St., Pittsburgh, Pennsylvania.

WALLACE TOUROPLANE: Total time, 250 hours; with Kinner motor, total time 54 hours. 3-place cabin, side-by-side duals, brakes, folding wings, Pioneer bank and turn, airspeed, compass, clock; licensed till October 1936. $975. Will take automobile or open ship as part payment. Deliver anywhere for expenses. John Herner, 933 Franklin Avenue, Brooklyn, New York.

REARWIN JR.: Latest Szekely; recovered January 1934; engine factory rebuilt July 1935; very good condition, $575. V. E. Doan, 505 W. Washington, South Bend, Indiana.

TAYLOR CUB with enclosure. Brand new. Just manufactured. Red and silver. $300 down, balance terms. Continental powered. Act quickly. Aviation Finance Co., Hemlock, New York.

CURTISS-WRIGHT SPORTSMAN: Model 16-K, 3 POLB; Kinner 125 h.p. engine. Absolutely perfect condition, superior performance. Extras aplenty. $1,650. Dick Schall (College Park Airport), Berwyn, Maryland.

BUHL PUP: Fabric and finish perfect, $395. Gypsy Moth, $700. LeBlond Klemm, $685. J-5 Travel Air, $895. Call, write, wire Pioneer Aviation, c/o Airport, Syracuse, New York. (Picture furnished, 25c deposit).

WACO F: Completely recovered; Warner, overhauled. Has hand rubbed finish. Bargain for $1,500. Might consider late car and difference. R. Nicklas, Fayetteville, Pennsylvania.

TAYLOR CUB: Continental, 180 hours total, enclosed; 5 months old and just like new. $1,075, or will trade for Stinson. C. M. Horstman, Airport, Schenectady, New York.

FAIRCHILD 21: Kinner K-5 powered. Open, two-place taperwing biplane. Recently relicensed. Ship and motor in excellent condition. $950 cash for quick sale. Reliable Flying Service, Inc., Bristol, Connecticut.

FOR SALE: Late model 2-place Taperwing Waco, 225 horsepower, very fast. Front cockpit cover; folding windshield; racing type landing gear; wing-root fairings; fuselage faired in; all control surfaces faired; full N.A.C.A. cowling; Hamilton steel adjustable steel propeller; sacrifice. AERO DIGEST, Box 2194.

FOR SALE OR TRADE: Waco F, clean, $1,300. Fairchild 22, A-1, $1,250. Porterfield, nearly new, $1,400. Ryan B-1, $1,450. Fokker Super Universal, no reasonable offer refused. B-7 Axelson motor, new, $300. Aviation Service Co., Inc., Box 32, Hartford, Connecticut.

FOR SALE: Waco F Warner, total time 235 hours; top overhaul 20 hours back. Special paint, hand rubbed finish; many extras. Glober Air Service, Municipal Airport, San Angelo, Texas.

J-5 EAGLEROCK: Excellent condition. Total time, 775 hours. Bendix wheels and brakes. $1,000. Consider car on trade. Dayton Orr, 1211 Newton Street, Austin, Texas.

1934 STINSON RELIANT: Gull wing, no flaps, 625 hours, 140 since major; large tanks, turn and bank, $3,600. 1933 Stinson Reliant: Executive model, radio, $3,250. (325 hours). 1933 Kinner Sportster: 350 hours, 250 on motor, starter, etc., $1,650. 1931 Waco cabin, 405 hours, 10 since major, lots of extras, $2,000. 1932 Taylor Cub: 550 hours, just completely rebuilt and recovered at factory, motor just majored, $750. Tank-powered Robin, new motor, 300 hours on ship, $850. All above ships are way above average and guaranteed in A No. 1 condition. Write or wire for detailed description. Neil R. McCray, Fairview, Erie County, Pa.

PITCAIRN PA-7m: Wright J6-7-D, 250 h.p.; direct electric starter, generator, retractible landing lights; licensed, absolutely A-1 condition. $975. Mulzer, Norton Field, Columbus, Ohio.

RYAN 5-PLACE CABIN: Needs overhaul and recovering; will sell with or without J-5 engine and propeller. Make offer. Pontiac Aircraft Co., Pontiac, Michigan.

ONE LOW-WING MONOPLANE: Two-place, side-by-side, duals, Velie motor, air wheels, always hangared, never cracked up. Price, $275. Joe Foster, 232 Hiland Ave., Anderson, S. C.

STINSON 1934 RELIANT: Repossessed. Total time honest 110 hours. Special paint, leather upholstery, lights and flares, radio, Smith controllable propeller. Never damaged. Priced right and will finance. Aircraft Finance Company, Curtiss Airport, Glenview, Illinois.

KINNER AMERICAN EAGLE: Extremely fine value, $685. Terms arranged. Warner Stinson, $850. Velie Monoprep, $500. Call, write, wire (picture furnished, 25c). Pioneer Aviation, c/o Airport, Syracuse, New York.

FORD TRIMOTOR: J-5's; total time, 575 hours; new type cabin and braking system; direct electric starters, generator, flares, Sperry horizon, lights; will take J-6 300 engines; this plane like new in every respect. Licensed, 14 passengers; best buy on market. Mulzer, Norton Field, Columbus, Ohio.

SPECIAL MODEL GREAT LAKES: Metal propeller, airwheels, brakes, pigskin upholstery, cockpit cowling, high polish finish. Excellent condition. $1,250 cash. J. Thomas, 2721 Grinstead Drive, Louisville, Kentucky.

CHALLENGER KR-31: Like new condition, completely rebuilt and recovered. Tanager red and silver finish; new propeller, wheels, tires and tubes. OXX-6, completely rebuilt, new cylinders, valves, etc. Sale or trade. Lester J. Sipe, Box 118, York, Pennsylvania.

LYCOMING STINSON: Newly licensed, $1,100. Terms arranged. Lambert Monocoupe, $1,400. J-6 6-place Buhl, $2,500. Write for appointment. (Pictures furnished, 25¢.) Pioneer Aviation Co., c/o Airport, Syracuse, New York.

FOR SALE: Wasp-powered speed wing Laird, 350 hours total time, front cockpit cover, navigation lights; condition excellent; NACA speed ring; price, $2,850. Mackey Flying Service, Findlay Airport, Findlay, Ohio.

PLANES and ENGINES FOR SALE

CURTISS WRIGHT JR.: A-1 shape. Licensed until August 1936. $300 cash takes it. Will deliver within 100 miles for expenses. Russell Rohertson, R. D. 1, Middletown, New York.

OX EAGLEROCK: Model A-2, completely recovered, $400. LeBlond 70 powered Overland Sport, $600. Huron Flying Service, Huron, South Dakota.

WARNER CESSNA: Recently completely overhauled; licensed to September 1936; four-seater. Pioneer Aircraft Co., Teterhoro Airport, Hashrouck Heights, New Jersey.

AERONCA MASTER C-3: Cabin demonstrator, with compass and heater. Few hours. New May 16, 1935. Never used for student training. $1,450. Orval Denlinger, 140 Warren Street, Dayton, Ohio.

SALE OR TRADE: Gipsy-powered Driggs Skylark, delivered from factory last June. Little time, fully equipped. Perfect condition. Real bargain. Jack Spencer, Grand Haven, Michigan.

MODEL S STINSON: Just relicensed; Lycoming, majored 200 hours ago; heavy crankshaft; radio, landing, navigation lights, flares. Also Model 2 Kinner Fleet, with extras. Reasonably priced. Thomas Metcalf, Transcontinental Airport, Toledo, Ohio.

FOR SALE: C-3 Aeronca with winter enclosure; lights and heater; ship is in excellent condition and priced right. AERO DIGEST, Box 2198.

WRIGHT J-5 STINSON: Four-place, just relicensed; over $400 recently spent reconditioning. Steel propeller, duals, starter, brakes, turn and bank, climb indicator, compass, air speed, navigation lights, etc. Terms arranged, trades considered; $1,275. T. Blodgett, Keyport, New Jersey.

FOR SALE: Salmson Aeromarine Klemm, excellent condition; refinished, airwheels, duals; relicensed May 1936; only 10 hours since relicensing. Will trade for good Continental 210 h.p. engine. Will pay cash difference good Rohin or other similar cabin ship. S. P. Daily, Teterhoro Airport, Hasbrouck Heights, New Jersey.

WACO F-3: Jacohs motor. Total time, 225 hours. 20 hours since top overhaul. Radio, pants, lights, flares, and special paint. New September 1, 1934. Jack Gillies, Aviation Country Club, Hicksville, Long Island, New York.

WACO "A": Late '33 Jacohs; no time since major; radio, bank and turn, Heywood starter, wheel pants, speed ring; yellow fuselage, green wings; excellent condition. Price $2,650. Great Lakes 2T1, licensed September 1936; Airwheels, wings and tail surfaces just recovered; excellent condition, $950. Straightwing Waco, 175 h.p. Wright J-6, 15 hours since majored and modernized; electric starter; tail wheel, fuselage recovered high lustre finish; real buy, $1,250. John T. Corrodi, Inc., Box 185, Bexley Station, Columhus, Ohio.

FOR SALE: Jacohs Cabin Waco; Stinson Reliants; Great Lakes; Bellanca Skyrocket and Pacemaker; Kinner Fleet; Warner Fairchild 24; Warner Fairchild 22; Lamhert Monocoupe; Warner Monocoupe; Stinson S. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

FOR SALE: Fairchild 22, like new, only 20 hours on Wright Gipsy motor. Aeronca C-3, 2-place, motor just rebuilt by Aeronca factory; new tires, extra instruments. Both ships guaranteed equal to new. S. Fraser, 2056 Ryder St., Brooklyn, N. Y. or Hangar 3, Floyd Bennett Field.

AVIAN: Latest model built. Excellent condition, very attractively refinished. Just relicensed; no time since last top overhaul. Bargain. Richard Behrens, 133 Lincoln Avenue, Mineola, New York.

FOR SALE: Waco F-3, Continental 210. Excellent condition; special color combination. Many extras. Priced for quick sale; will consider smaller ship in trade. AERO DIGEST, Box 2199.

ENGLISH CIRRUS: Mark III; 95 h.p. engine, brand new, complete in original crate as shipped from factory; $275. N. W. Perdew, Hashrouck Heights, New Jersey.

BUHL PUP: Good condition, with newly overhauled engine. Any reasonable offer considered. Address Grover Nash, Curtiss-Reynolds Airport, Glenview, Illinois.

FAIRCHILD 24: Demonstrator, one year old; equipped with heater and generator. C. R. Nuckols, Box 53, Oklahoma City, Oklahoma.

TRAVEL AIR: Warner 125. No time since motor majored. Excellent condition throughout. $890 cash or will trade. Write for complete airplane list. Two J-5 motors and complete list J-5 parts. R. C. Downing, S.S. Station, Box 532, Springfield, Mo.

LYCOMING STINSON SM8A: $1,650. OXX-6 Rohin, $650. OX-5 Waco, 10, $450. All ships licensed and motors major overhauled. Take light late model car in trade. V. Cavasino, Box 523, Bismarck, North Dakota.

COMMAND-AIRE: Siemens 113 h.p.; 3 POLB; 10 hours since pistons, rings and top overhaul. Colored silver and Gelatina orange, trimmed in black; new instrument panel; $650. Waco 10 OX-5: Fuselage recovered, wings redoped; Scintilla magneto; 26" full air wheels, speed windshield; top overhaul 15 hours ago; snappy paint job; Stearman vermilion and Army yellow; $500. Both planes have duals and licensed to December 1936. Want Waco F, F-2 or cabin. Boh Gilfert, Tamaqua, Pennsylvania.

FOR SALE: Waco F-3, Continental 210 engine, Hamilton steel propeller, wheel pants, electric starter, bank and turn, rate of climb, air speed; altimeter and air speed in both cockpits; special paint job; 65 gallon gas tanks; many extra features; 127 hours total time; priced $2,750. Muncie Aviation Corp., Muncie, Indiana.

LATE 210 H.P. Waco Cabin and F-2. Excellent condition. Many extras. May accept Waco F-5 in trade on either. Altoona Aviation Corp., 2503 Union Ave., Altoona, Pennsylvania.

STINSON MODEL S: Complete with turn and bank, rate of climb, clock, retractable landing lights. Waco F: Warner, complete with starter, speed ring, steel propeller, special paint job, black fuselage with red wings. Two 1935 Taylor Cubs, Continental. These ships can be financed to responsible buyers. Ray Hylan, Municipal Airport, Rochester, N. Y.

J6-5 WACO STRAIGHTWING: Total engine time, 500 hours; 300 hours since major and modernization. 50 hours since top. Ship in excellent condition. Price, $1,185. Beechcraft Sales & Service, Hangar 9, Roosevelt Field, Mineola, New York.

BEST OFFER takes Wright J6-7-A with starter, 850 x 10 tires, tubes, wheels, brakes (never used), Smith controllable propeller (like new), Standard Hamilton props for J6-7, J6-9. G. D. Kelsey, Municipal Airport, Philadelphia, Pennsylvania.

FAIRCHILD 24: Warner 125; two-place; Heywood starter; ship completely reconditioned, wings recovered; 75 hours since major; black and red. Leech Aircraft, Inc., Armonk Village, New York.

KINNER BIRD: Just recovered, $1,100; terms arranged. Waco F, $1,500. J6-5 Stinson, $1,000. Aeronca, $885. Write for details (picture furnished, 25c). Pioneer Aviation, c/o Airport, Syracuse, N. Y.

OX TRAVEL AIR 2000: Licensed until September 1936. 375 hours on ship. 160 hours since major on engine. Wings and fuselage covered last year. $400. AERO DIGEST, Box 2203.

FOR SALE: One de luxe Warner Fleet, new covering; maroon Stinson finish; Airwheels, metal prop, extras; excellent condition, $1,050. Whittelsey Avian: Cirrus-powered; large wheels and tires; good condition, with spare engine, $595. De Luxe Great Lakes Trainer: Inverted Cirrus, metal prop, airwheels, pants, streamlining, turn and bank, compass, many extras; very little time both ship and engine; $1,005. J-5 Waco: Ship and engine, flown very little and in like-new condition. Starter, speed ring, compass, rate of climb, turn and bank, airwheels, front cockpit cover and many other extras. Just refinished; $1,300. Three J-5 engines, complete with Hamilton metal props, starters, etc., $250 each. One Hornet "A" engine, $500. J-5, Challenger, Lycoming; Challenger parts; parachutes, instruments, flares; Travel Air parts, very reasonable. Fleet parts, new and reconditioned metal props, $40 to $80. Wanted: Spartan right lower panel. Associated Aviation Corp., Curtiss-Wright Airport, Highway 41, Milwaukee, Wisconsin.

STINSON 1934 RELIANT: Built 1935; black and red paint, controllable pitch propeller, 75 gallons gasoline, bank turn, rate climb, radio, red leather, 311 hours, wired landing lights, flares. Leech Aircraft, Inc., Armonk Village, New York.

PRICED TO SELL: J-5 Laird Sportwing, in excellent condition; Kinner K-5 Davis, like new, total time 125 hours; Taylor Cub. 13 months old, like new; best and most beautiful 4-place Kinner Bird in country; OX Laird, Diana cream and green, beautiful and fast. Terms to responsible buyers. Indiana Air Service, Airport, South Bend, Ind.

FOR SALE: Caproni 2-place; Wright Gipsy, majored; wings recovered, ship repainted; oleo landing gear, rebushed. Air wheels. Inexpensive to operate; licensed November 1936. $750. Joseph Browne, 1054 McBride St., Far Rockaway, L. I., N. Y. Phone: Far Rockaway 7-4355.

D. H. GIPSY MOTH: Semi-air wheels, recently majored, licensed to April 1936. Ship and fabric excellent condition. $600 cash. R. P. Hazzard, Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

KR-34 FAIRCHILD: 125 h.p. Warner engine; airplane and engine in perfect condition; licensed to November 1936. Can be seen at Teterboro Airport, New Jersey, on Sundays. Weekdays by appointment. $800. V. A. Johnson, 625 Bloomfield Ave., Clifton, New Jersey.

STINSON: 1934 model SR-5; complete with Smith propeller, large gas tanks, radio, full instruments and night flying equipment. Ship in excellent condition. Total time 445 hours. Best offer prior to January 1, 1936, buys this one. AERO DIGEST, Box 2205.

FLEET: Model 9, Kinner 125 h.p.; starter, navigaton lights; total 522 hours; engine 283. $1,750. Franklin, Lamhert 90, 200 hours, $1,200. Monocoupe, Warner 125, starter, $2,250. Bird, 4-place, Kinner B-5, 125 h.p., starter, $1,750. Stinson, Lycoming 245, starter, $3,950. Waco cabin "C," blind and night flying equipment; total 95 hours, $4,300. Fairchild 22, Cirrus 90 h.p., $1,350. Full particulars on any of above, or others on request. The Walz Corporation, Central Airport, Camden, New Jersey.

DRIGGS SKYLARK: Rover motor; privately owned; just factory overhauled; semi-airwheels; brakes, winter enclosure, instruments. Take ship or car on trade. AERO DIGEST, Box 2207.

FOR SALE: Best Taperwing Waco in the country, powered with fully modernized series D J-6 250 h.p. engine. Bargain for cash. Troy Flying Service, Troy, Ohio.

WACO F: Kinner 125; just majored; perfect condition; licensed until August 1936. W. Kemp, Westchester Airport, Armonk, New York.

$850 BUYS Kinner American Eagle: Brakes, dual instruments, licensed June; just majored; cover and paint good. Montgomery School Aeronautics, Montgomery, Alabama.

CONTINENTAL CUB: $650. Fuselage just recovered. Licensed until November 1936. J6-5 Travel Air, licensed until March 15, 1936. Taylor Aircraft Company, Bradford, Pennsylvania.

STINSON SM8A: Lycoming; S landing gear; 850 x 10 tires; electric starter, navigation lights, duals, $1,450. Travel Air 2000: Excellent condition. Parks P-2: Axelson 150 h.p., $750. Wolf Flying Service, Inc., Lock Haven, Pennsylvania.

FAIRCHILD 22 for sale: Cash, $1,450. Time, 263 hours. Relicensed one year. Excellent condition. One Taylor Chummy, powered with Kinner, $750. Factory rebuilt, good condition. Relicensed one year. Cabin enclosed. Time, 245 hours. New and used Cubs for sale. Wire or write Camel City Flying Service, Inc., Box 1941, Winston-Salem, North Carolina.

WARNER FLEET: Guarantee this to be the finest Warner Fleet in the country, $1,185. St. Louis Flying Service, Incorporated, Lamhert Field, St. Louis, Missouri.

WATKINS SKYLARK: LeBlond 85 low-wing, 2-place. Speed ring, duals. Cover and finish very good. Identified. $395 or will trade. Norman Kramer, Syracuse, Kansas.

DEADLINE FOR CLASSIFIED ADVERTISING, JANUARY ISSUE—DECEMBER 19th

Copy arriving after that date will be held over for the February issue

CLASSIFIED ADVERTISEMENTS

10c. Per Word; $2.50 Minimum. Payable in Advance.

CURTISS-WRIGHT SEDAN: Challenger 185, $1,350. J-5 Ryan B-1, $675. Kinner Eagle, front exhaust, steel prop, $925; side exhaust, $725. OX-5 Eaglerock, $325. All licensed. OX motor, $25. Imm, Fergus Falls, Minnesota.

FOR SALE: Curtiss Thrush, 6PCLM; modernized J6-7-D; anti-drag ring; new Bendix wheels and brakes; ship in A-1 condition; operates excellently out of small fields; licensed June 1936. $1,650. Joseph Browne, 1054 McBride Street, Far Rockaway, L. I., N. Y. Phone: Far Rockaway 7-4355.

AERONCA: Two-place, winter enclosure; very little time; ship and motor like new; price, $750. Austin Municipal Airport, Austin, Texas.

● WANTED TO BUY OR TRADE

WANTED: 100 or 125 h.p. Kinner low wing. Will pay cash or trade Warner F. State particulars in first letter. Southern Air Services, Inc., Municipal Airport, Memphis, Tennessee.

WANTED: Cash for two- or three-place late model 90 to 125 horsepower plane perfect condition, priced for re-sale. C. F. Williams, Miami, Oklahoma.

WANTED: Licensed air-cooled 3POLB. Prefer American Eagle, Waco or similar ship. Must be cheap. $350, balance monthly. Give full details in first letter. AERO DIGEST, Box 2187.

WANTED FOR CASH: Aeronca, Fledgling, Waco F or Travel Air or such, needing rebuilding and recovering; with or without motor; will bid on any crack-up. Frandell Laboratories, 235 Ridge Road, Wilmette, Illinois.

WILL TRADE my dance pavilion and three-room house for good airplane. Pavilion $4,300 value and good business. Have 6.50 x 10 wheels tires and brakes and OX-5 Eaglerock. Have room for six or seven planes in good brick hangar for storage. Mobridge Airport, Mobridge, South Dakota.

CASH: For your airplane or airplane parts in any condition. Want J-5, J-6 motors, parts, propellers, air wheels and instruments. Write details in first letter. J. E. Poisson, 1219 Penn Avenue, Grand Rapids, Michigan.

TRADE: 18-foot runabout speed boat, solid mahogany, 103 h.p. Gray marine motor, run only 50 hours; one year old; deliver radius 300 New York City. Wanted: 3-place open biplane, air-cooled. AERO DIGEST, Box 2191.

PARACHUTE: Irvin Training Outfit with 28-foot back pack, 22-foot chest or 28-foot standard back pack. Roland Kumzak, Milford, Iowa.

WANTED TO TRADE: One Russell 24-foot seat pack chute, for good Miller overhead. A-1 condition. AERO DIGEST, Box 2189.

FLEET, ON FLOATS: Will buy ship, floats separately. Pay all cash. Want pistol flares. Must be bargains. Dick Schall, Berwyn, Maryland.

WANTED: Waco F with Warner or J6-5 Travel Air; must be in good condition. Will trade 1934 Harley-Davidson motorcycle 74, excellent shape, gone 7,000 miles; balance in cash. Give complete details in letter. Nicholas Myers, 2311 Atlantic Avenue, Atlantic City, New Jersey.

WANTED: Cash for any two-place light plane, regardless of condition, if priced right. State all details in first letter. Reliable Flying Service, Inc., Bristol, Connecticut.

AERONCA, TAYLOR CUB or other light closed plane wanted. Trade 1934 Buick 4-door sedan, 60 series, excellent condition. Franz Duelherg, 308 Passaic Ave., Nutley, New Jersey.

WANTED: Used aircraft instruments. Gyro-horizon, directional gyro. Rate of climb, turn and bank. Aircraft generators and starters. Lincoln Airplane and Flying School, 2415 "O" Street, Lincoln, Nebraska.

WANTED: Wright J6-9 engines. any condition. Bahh, 1100 Airway, Glendale, California.

WANTED: Two used Warner motors, 110 or 125 h.p., also two Kinner model B or K. AERO DIGEST, Box 2195.

WANTED: Motor, 45 to 60 h.p. Also lower left wing for New Standard trainer D-29-A. C. U. Price, Swanton, Vermont.

J-5 LOCKHEED WANTED (or similar ship). Sell or trade 4-place B-5 Bird. Beautiful condition. Privately owned. Herrington, 209 E. Mifflin St., Madison, Wisconsin.

WANTED: Aeronca E-107-A motor. Also crankcase, crankshaft and connecting rods for same. Need some E-113 parts. What have you? Fred Myers, 12824 Superior, Cleveland, Ohio.

WILL BUY FOR CASH late front exhaust Kinner Bird. State full information first letter. Must be sacrifice price. R. Merritt, 1448 Elmwood Avenue, Lakewood, Ohio.

CASH FOR EDO floats for Aeronca Master C-3. State condition, price, etc. AERO DIGEST, Box 2196.

WANTED: Ryan or Cessna with J-5 motor preferable; also Monocoupe or Monoprep. Planes in any condition will be considered. Elwyn West, Route 3, Appleton, Wisconsin.

WANTED: Continental A-40 crankshaft. State lowest cash price, first letter. For sale: Heath B-4. Write for details. Edward Molitor, 101 Storer Avenue, Pelham, New York.

CASH PAID: For your airplane or parts in any condition. Want engines, parts, airwheels. State full particulars in first letter. Floyd Becker, Aberdeen Road, Grand Rapids, Michigan.

WANTED: Curtiss Robin oleo struts, Continental 210 cylinders. Late type 125 Warner engine. Taylor Cub parts. G. D. Kelsey, Municipal Airport, Philadelphia, Pennsylvania.

CASH: Wants to buy cracked-up late model airplanes, using air-cooled engines, and those needing recovering; also J-5 main case. Must be priced right. Indiana Air Service, South Bend, Indiana.

WANTED: Licensable airplane in any condition, without engine, built to use a Kinner K-5 engine. Edward D. Tracht, Galion, Ohio. Route 3.

WANTED: Motor mount (Kinner K-5) for Bird, also cowling and oil tank. For sale: OX-5 motor, good condition, cheap. Complete cowling and radiator for OX Bird. Goodyear Airwheels, complete with adapters. P. Haynes, 434 Solon Street, Toledo, Ohio.

WANTED: Wing for American Eaglet, or right wing panel; (cash). Paul Gingrich, Main Line Airport, Malvern, Pennsylvania.

WANTED IMMEDIATELY: Either 1933 or 1934 Lycoming engine. State full details and lowest cash price. Air Service, Inc., Bellanca Field, New Castle, Delaware.

● MISCELLANEOUS PRODUCTS AND EQUIPMENT

AIRCRAFT RADIO: RCA type AVR-2 12 volt, six tube superhet, complete; list $250, sell $110 cash. Pioneer type 718B flush-mounting compass, list $35, sell $10 cash. Jack Gaty, 62-10 Woodside Avenue, Woodside, L. I., New York.

FOR SALE: Dixie magneto switches, 49¢; fuel pressure gauges, 47¢; oil pressure gauges, 59¢; engine priming pumps, 77¢; distance temperature gauges, $1.98; Johns-Manville tachometers, $5.98; booster magnetos, $4.95; Star Pathfinder compasses, $12.87. Send dime for catalog full of other bargains. Karl Ort, 612 W. Poplar St., York, Pa.

OX-5 MOTORS: New rod and main bearings, completely reconditioned and run in. LeBlond 5-D, overhauled. Lewis Holy Name School of Aeronautics, Lockport, Illinois.

FOR SALE: Reasonable; practically all parts of Travel Air 2000. Rudolf G. Billherg, Roseau, Minn.

IF IT FLIES, WE HAVE IT: Practically new late model D Wasp motor, $1,400. D.H. Moth motor, $185. Salmson 40, complete with propeller and mounting, equal to new, $200. Woollen army breeches, $1.25. 10 x 3, 500 x 3, 500 x 4, 14 x 3 tire and tube, $5; wheels, $3.50. 24 x 4, 26 x 3-4-5, 28 x 4 straight side non-skid tire, $3.50 each. Larger size, $5 each. All sizes wheels from $1 to $3 each. Standard steel propellers, all sizes, $50 to $150. Variable pitch Hamilton propeller, best offer. Motors and parts for Wright Cyclone model R-1820 F. Wasp, Hornet, Liberty, Hissos, OX-5, OXX-6, Hall Scott, Mercedes, Whirlwind and other makes of air-cooled motors. New Siemens-Halske 5-cylinder radial motor, in original crates, 70 h.p., $250. New B.G. 4-B spark plugs, 50c. AC, Champion, Splitdorf, 25c. Motor generators, 10 volts input, 300 volts output, $10. New Fahrenheit temperature gauges, 12′, $1.90. 3½" dial new altimeters, $3. Tachometers, $7.50. G.E. compass, $5. Oil and fuel gauges, $1 each. B 2-3-4 engine throttles, $2 to $3.50. Engine primers, choke controls, 50c. Scintilla, Bosch 2- to 12-cylinder magnetos, $25. Seven ignition wrenches in case, 25c set. White Irvin parachute with pack, $75. Turnbuckles, shackles, clevis pins, nickel steel bolts, large quantity—exceptionally low prices. We carry everything for airplanes. See us for bargains. Crawford Airplane Supply Company, Venice, California.

FOR SALE: Edo de luxe floats and struts for J-5 Waco. Wanted: Aeronca motor E-113-A and Aeronca floats. Glenn T. Clark, 803 Sixth St., Charleston, West Virginia.

FOR SALE: Fleet parts. Everything, including lower wings, 60% off factory list price. Also limited number type 354 Pioneer air speed indicators 0-200 m.p.h., $10; Pioneer supercharger gauges, $20; 347 Pioneer tachometers, $15. Stevenson-Weeks Air Service, Inc., Municipal Airport, Kansas City, Missouri.

AIRPLANE PARTS: Travel Air Sport 12-Q parts. Travel Air 2000 wings and parts. Great Lakes new lower left wing. Three new 6.50 x 10 inner tubes. Kingsville Cabinet Shop, Kingsville, Missouri.

CONTINENTAL rocker arm ball bearings replaced, new method, new bearing; $3.50 per arm installed. Valve seats and guides and bearings installed in any motor; quick service, guaranteed work. Get our quotations. Most complete line of engine replacement parts, especially in oversizes. 24 hours service. Air Transport Equipment, Inc., Hangar 20-A, Roosevelt Field, Garden City, N. Y.

WRIGHT J-5 ENGINE: Overhauled by approved station. J-5 main section. Large stock of J-5 and J-6 parts. Propellers; instruments; Wright service tools, including bearing jigs and reamers. Lycoming service tools, including bearing jigs and reamers. Cyclone service tools; Wasp service tools. Sioux valve facer. DeVilbiss spray outfit. Pressure tank and cups. New Cincinnati time recorder. New Toledo scales. All steel stock bins. Engine overhaul stands and parts racks. Write for prices. Pontiac Aircraft Company, Pontiac, Michigan.

ENGINES: Rebuilt, excellent condition. American and English Cirrus. OXX-6. Stock of parts for American and English Cirrus and Kinner K-5. Lester J. Sipe, Box 118, York, Pennsylvania.

FLIGHTEX WING COVERS: Command-Aire, Waco, Travel Air, Swallow, American Eagle, $10. Fuselage covers, $12. Others proportionately. Dope, $1.25 gallon; thinner, $1.25 gallon. Ostergaard Aircraft, Parr, Indiana.

FOR SALE: Propellers, Hamilton Standard steel, Wasp and Hornet, two and three blades. Propeller blades, $15 each, equal to new, approved types. Turn and banks, $20. Tachometers, compasses, etc. Want: Engines, all types, parts, other equipment. Box 1457, Tampa, Florida.

HISSO 150, 180 and 300-360 engines and parts at ridiculously low prices. These make excellent speed boat engines when converted. Write for quotations on your requirements. Karl Ort, 613 W. Poplar St., York, Penna.

WACO F WINGS: Complete set of rebuilt Waco F wings carried in stock at all times for immediate delivery. Will make fair exchange for damaged wings or sell outright at reasonable prices. Chicago Aviation Corporation, Glenview, Illinois.

WINGS, SPARS, RIBS: Large stock of wings. Laminated, routed and box spars made to order. Quick service and reasonable prices. Chicago Aviation Corp., Glenview, Illinois.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

WACO 10: Rebuilt like new. Waco 10 wings and parts. J-5 motor in excellent condition. Heywood for J-5. Ryan B-5 motor mount, new. Velie parts. Charley Raudabaugh, 13210 French Road, Detroit, Michigan.

J-5 ENGINE: Needs major, disassembled, $100; J-6 Standard Steel propeller, 20 hours since factory reconditioning, $75; Trimm headphones, new, $3.50; Waco F lower aileron, $7.50; 3-blade Standard Steel propeller; Velie Cavalier, uncovered, less motor, as is, $97.50; OX-5 Eaglerock; Cirrus parts. C. R. Nuckols, Box 53, Oklahoma City, Oklahoma.

2 NEW KINNER exhaust manifolds, $35 each. Baffle, $18. Three new J-5 and J-6 speed rings, $40 each. Also used exhaust rings. Engel Aircraft Specialties, Glendale, California.

ROBIN PARTS: Millerized OX-5 with aluminum prop; 1700 r.p.m. in air; 8 hours since complete overhaul; $125. Less prop, $90. Left wing, new covering, perfect, $75. Struts, oleo shocks. Sahella's Aero Salvage, Jamaica Sea Airport, Jamaica, N. Y.

ENGINE PARTS: OX, Miller overhead and Scintilla mag. $50. Overhauled Berling magneto, $10. Warner diffuser case, $30. Rear section Warner crankcase, $25. Kinner main crankcase, $25. Kinner crankshaft, $30. Kinner master rod assembly, $20. Kinner cam guide assembly, each, $2.50. Kinner cylinder less head, standard, $6. Steel propeller for Warner, $60. Kingsville Cabinet Shop, Kingsville, Missouri.

WESTINGHOUSE heat treating soldering furnace, type C, size 1500, style S.O. 17252, 220 volts; maximum temperature 950 F. Complete with panel board and controls. AERO DIGEST, Box 2206.

WACO 10 PARTS: Wings, fuselage, tail assembly and spare sparts. John Rogers, 5513 Westford Road, Philadelphia, Pennsylvania.

A CHRISTMAS GIFT your friends would appreciate would be an aircraft altimeter either for use in a plane or car. We have a limited supply for $3.75 each while they last. Also wood propellers for Wright J-5 and J-6 engines at one-third original cost. Troy Flying Service, Troy, Ohio.

PARACHUTES FOR SALE

PARACHUTES: Approved types, used, $50 up. Navy surplus, 18-ft., new white silk chutes, $4 each postpaid; no C.O.D.'s for one. Southern airport managers contact Aurora for route of our air show performers. Thompson Bros., Balloon & Parachute Co., Aurora, Ill. Established 1903.

POSITIONS WANTED

PILOT-EXECUTIVE: Army trained. Transport license. Perfect business and flying record. Over fifteen years of excellent continuous connections in sales, banking and secretarial work. Experienced night, instrument and cross country flying. Never unemployed and at present well situated, but desire responsible position involving some flying or with aviation industry. Age, 35. AERO DIGEST, Box 2197.

PHOTOGRAPHER: Experienced technician, aerial mosaics, news and commercial. Expeditions, air schools, corporations, publications and mapping companies needing a staff photographer. Finest references. AERO DIGEST, Box 2188.

LICENSED AIRPLANE MECHANIC: Age 21, married. 2½ years experience, repair shop and factory. College graduate. Desire any permanent connection. Write M. Vance Shellahamer, Middle River, Maryland.

TRANSPORT: Three thousand hours; expert instructor. Fly for anyone, one hundred month for three months and expenses away from headquarters. Then contract if satisfactory. Box 162, Arcadia, Louisiana.

TRANSPORT PILOT: A & E mechanic, radio operator; experienced night and blind flying, student instruction. 1-A and 2-A rating. Go anywhere. Salary immaterial. Excellent references. Lenox Hodge, Radnor, Pennsylvania.

CLASSIFIED CLOSING DATE FOR JANUARY

December 19th

HELP WANTED

HELP WANTED: Licensed pilot. State all first letter—weight, age, experience, references, etc. Operate out of Jacksonville, Fla. Correspondence confidential. AERO DIGEST, Box 2202.

MISCELLANEOUS SERVICES, OPPORTUNITIES, OFFERS, ETC.

ACCOUNTANT will exchange accounting and tax service for flying instructions in New York metropolitan area. AERO DIGEST, Box 2186.

I HAVE A SLOGAN that says I am a good advertising man and that I ought to be selling airplanes. I want $5,000 in cash for the slogan and $5,000 per year to continue. AERO DIGEST, Box 2192.

AIRPORT OPERATORS: We are distributors and have in stock new Taylor Cubs and Rearwin Sportsters available for distribution and delivery to your customers. Sign up for agency now. Have several used bargains received in trade. Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey. Also Hangar 33, Roosevelt Field, Mineola, New York.

A REAL OPPORTUNITY for young men to get started in the most profitable branch of aviation; a chance to become connected with one of the best known concerns in the industry, backed by ten years' experience. Financial returns will be large beginning the first year to the man who can qualify for the position which is open. $2,500 capital required. AERO DIGEST, Box 2190.

CABLE SPLICING INSTRUCTIONS: $1.00. A. G. Breton, 163 Virginia St., Hillside, New Jersey.

LEARN TO FLY at reduced rates by working as mechanic's helper and earning room and board at same time. Send references and photo in first letter. AERO DIGEST, Box 2201.

OPPORTUNITY: Engineer with design for superior low-cost airplane wishes to contact several young men who wish to enter aircraft manufacturing. Investment required. AERO DIGEST, Box 2185.

FOR SALE OR LEASE: Established flying service on very large and busy airport complete with five modern airplanes, servicing facilities, also paying contracts. Reason, poor health. AERO DIGEST, Box 2200.

THE BENNETT PLAN places new airplane in operation for you. Ideal for flying clubs, also for pilots wishing to start in business. Little or no capital necessary. You can earn $40 to $100 weekly following our plan. Write Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey.

INFORMATION DESIRED as to the whereabouts of Leon N. W. Colin. Please communicate with wife. AERO DIGEST, Box 2204.

BUILD UP FLYING TIME: Students and private pilots. 50 hours, $100. Modern equipment. Edward DePouli, 952 McLean Avenue, Yonkers, N. Y. Call Beverly 8964, 7 to 9 P. M.

WINTER STORAGE: We are offering dead storage on planes in modern fireproof hangars at forty dollars for six months or ten dollars by the month. Ships called for and delivered for expenses. Airport, Natick, Massachusetts.

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This book covers the same ground as the course given the enlisted mechanics of the Army Air Corps, with the addition of much data on types of equipment adapted only for commercial airplanes. It deals thoroughly with all kinds of aircraft engines and their accessories.

Mr. Moors gives all needed data on construction and operation, supplies full instructions for proper maintenance, and shows you exactly how to go about making any necessary repairs and adjustments.

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A PRACTICAL GUIDE FOR PILOTS:

Navigation of Aircraft

by Lieut. Logan C. Ramsey, ***U. S. Navy; Instructor in Aerial Navigation, Pensacola Naval Air Station.*** **51** ***illustrations.*** **$4.50.**

Covers the practical, everyday sort of navigation every pilot must know. Emphasizes dead reckoning, including plotting, course setting, determining and correcting for wind effects, etc. Piloting and navigation by aerial astronomy are also fully explained. In addition to its major presentation of the principles and practice of position finding by calculation and observation, the manual covers fully maps, instruments, and accessories; compasses; navigational practice, etc.

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The compass reading is 230°, the variation is 18° E, the deviation is 7° W. Determine the true heading.

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What is the effect of having an adjustable stabilizer too high when landing?

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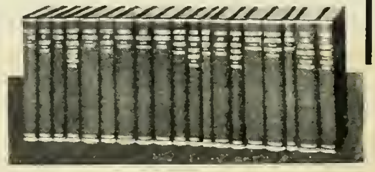

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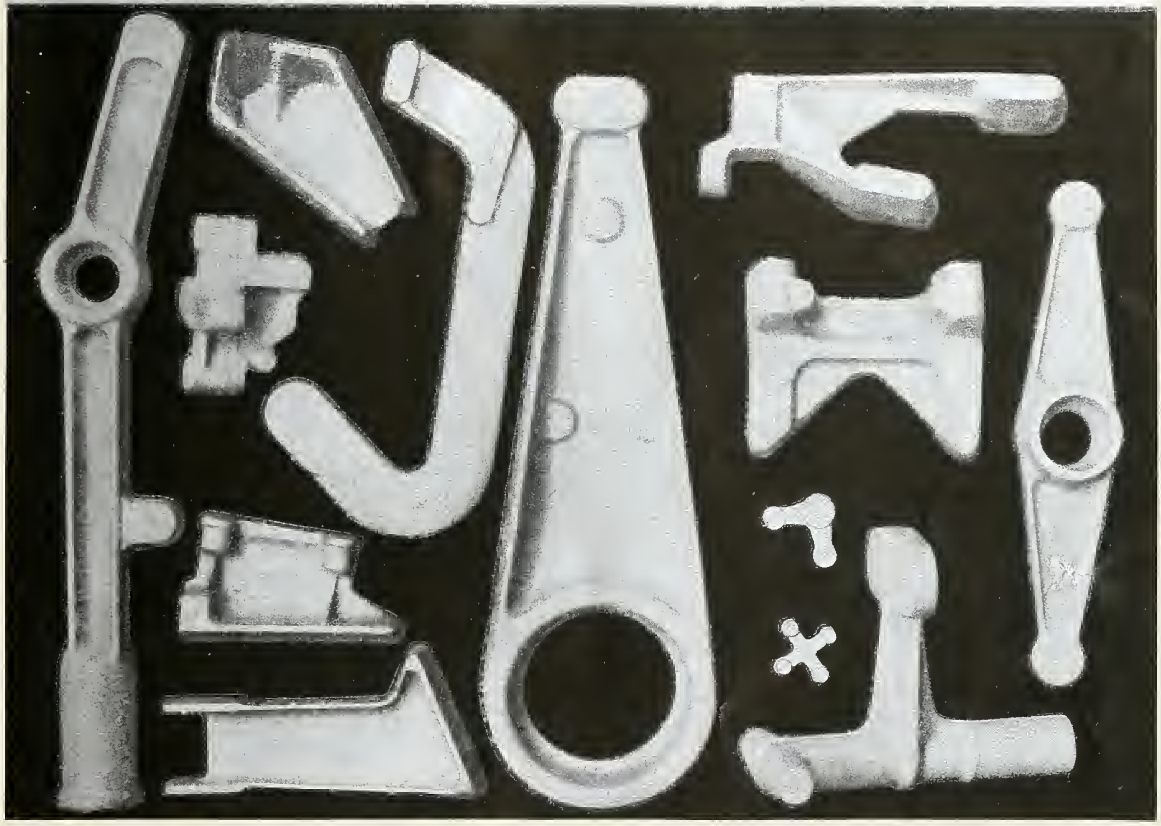

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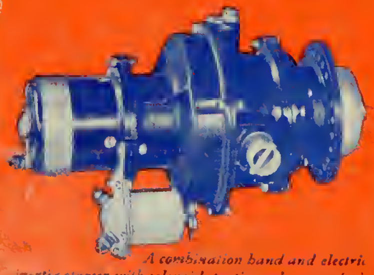

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